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ABSTRACT

This volume is the ninth in a series of 29 coordinated MINNEMAST units in mathematics and science for kindergarten and the primary grades. Intended for use by first-grade teachers, this unit guide provides a summary and overview of the unit, a list of materials needed, and descriptions of four groups of lessons. The purposes and procedures for each activity are discussed. Examples of questions and discussion topics are given, and in several cases ditto masters, stories for reading aloud, and other instructional materials are included in the book. The lessons in this volume are organized into four sections: (1) one-to-one correspondence, (2) tallying, counting, and reading numerals from 0 to 20, (3) writing numerals and counting practice, and (4) ordering and the order-signs. A variety of topics related to these threads is included; among these are estimation of large numbers and names for numbers in other languages. (SD)

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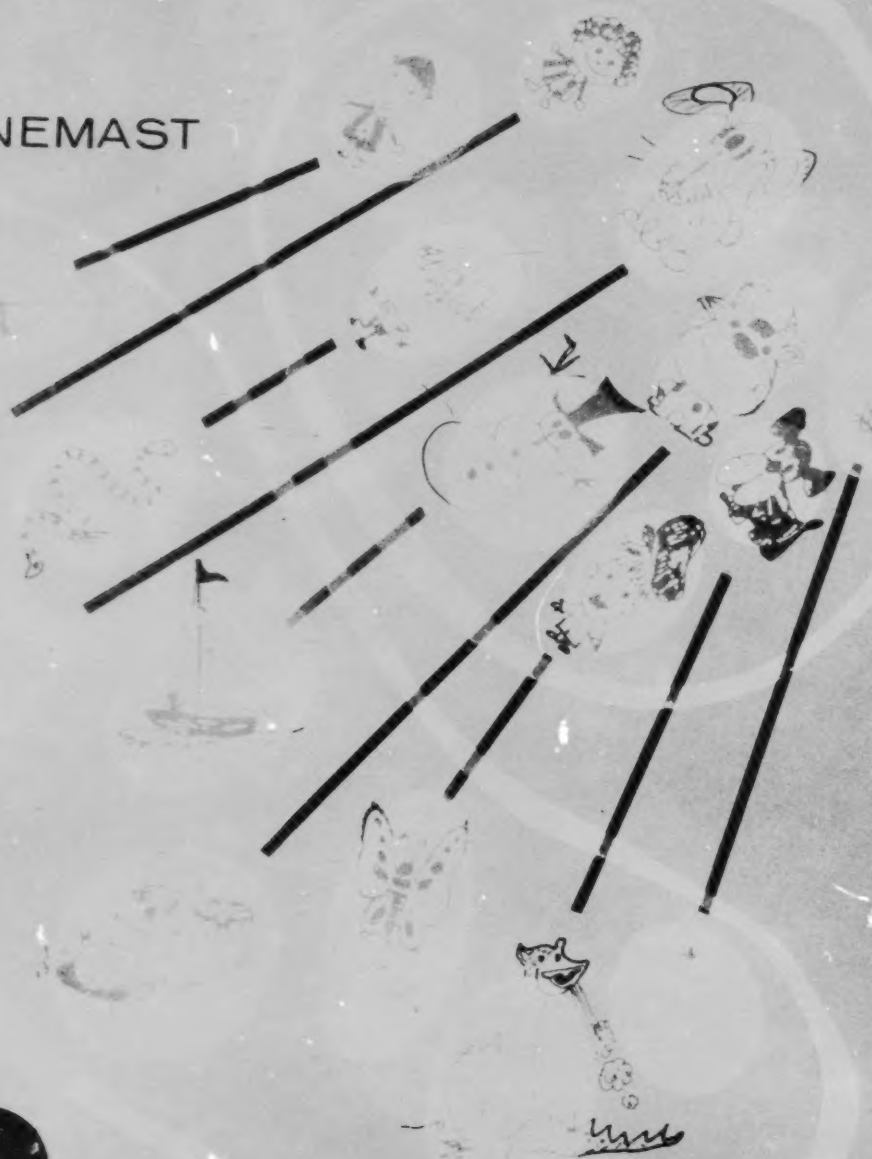

UNIT 9

NUMBERS and COUNTING

MINNEMAST COORDINATED MATHEMATICS–SCIENCE SERIES

KINDERGARTEN

1. WATCHING AND WONDERING
2. CURVES AND SHAPES
3. DESCRIBING AND CLASSIFYING
4. USING OUR SENSES
5. INTRODUCING MEASUREMENT
6. NUMERATION
7. INTRODUCING SYMMETRY
8. OBSERVING PROPERTIES

FIRST GRADE

9. NUMBERS AND COUNTING
10. DESCRIBING LOCATIONS
11. INTRODUCING ADDITION AND SUBTRACTION
12. MEASUREMENT WITH REFERENCE UNITS
13. INTERPRETATIONS OF ADDITION AND SUBTRACTION
14. EXPLORING SYMMETRICAL PATTERNS

SECOND GRADE

15. INVESTIGATING SYSTEMS
16. NUMBERS AND MEASURING
17. INTRODUCING MULTIPLICATION AND DIVISION
18. SCALING AND REPRESENTATION
19. COMPARING CHANGES
20. USING LARGER NUMBERS
21. ANGLES AND SPACE
22. PARTS AND PIECES

THIRD GRADE

23. CONDITIONS AFFECTING LIFE
24. CHANGE AND CALCULATIONS
25. MULTIPLICATION AND MOTION
26. WHAT ARE THINGS MADE OF?
27. NUMBERS AND THEIR PROPERTIES
28. MAPPING THE GLOBE
29. NATURAL SYSTEMS

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NUMBERS and COUNTING

MINNEMAST COORDINATED MATHEMATICS-SCIENCE SERIES

UNIT 9

MINNESOTA MATHEMATICS AND SCIENCE TEACHING PROJECT

The Minnesota Mathematics and Science Teaching Project

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1971

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MINNESOTA MATHEMATICS AND SCIENCE TEACHING PROJECT

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This unit, Numbers and Counting, was developed by the MINNEMAST staff from earlier MINNEMAST materials, revised in the light of the experience of the many teachers who have tried the activities in the classroom. This trial edition, Unit 9 of the MINNEMAST Coordinated Mathematics-Science Series, was produced under the leadership of:

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Complete List of Materials for Unit 9

(Numbers based on class size of 30.)

total number required to teach unit	item	lessons in which item is used
2	sets of counters, 40 in each set, e.g., 40 seeds or 40 rocks	1
60	* corks	2
1	checkerboard	2
68	checkers, 34 red, 34 black	2
100	counters	3,5,11,12, 19,23
20	* paper cups	3
1	box or bag	3,5
30	dice	3,25
1	** "Ugboo" story	4
1	*** set of demonstration Minnebars	7
30	*** sets of Minnebars	7,10,18,23
30	* sets of shells	8
30	* 18-inch lengths of white yarn or string	8
30	* 18-inch lengths of blue yarn or string	8
1	flannel board	10,24
3-5	sets of objects for flannel board	10
21	9" x 12" cards	11,12,13
2	large packages of 4" x 6" index cards	10,11,12,16, 23,25
9	* pegboards	11,12,16,19
20	different pictures	13
90	sheets of newsprint	16,17,18

30	boxes of crayons; pencils	16,17
1	set of dominoes (optional)	24

*kit items as well as

**printed materials available from
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***available from The Judy Company,
310 North Second Street, Minneapolis, Minnesota 55401

INTRODUCTION

SUMMARY OF CONTENTS

This unit contains:

- A review and extension of the concepts of comparison of members in sets by one-to-one pairing and by counting.
- Activities to develop the ability to read, write, and order the numerals from 0 to 20.

BACKGROUND

The children have had experience in classifying sets according to a property in Unit 8, Observing Properties. In this unit on Numbers and Counting, they discover that sets which can be paired in a one-to-one way with one another have a common property of number. If one of two sets has one or more members left over after a one-to-one pairing is attempted, the numbers of members in the sets are not equal.

Two sets can be compared indirectly by comparing each set with a third reference set, such as a set of tally marks on paper. If each of the two sets is in one-to-one correspondence with the reference set, the sets are in one-to-one correspondence with each other. This is useful when two sets are not easily brought together.

The set of reference objects or marks can be replaced by a set of words in a definite order. Counting is the pairing of the words in the accepted order with the members in the set to be counted. The last word paired gives the number of members in the set.

This unit follows the above sequence of ideas in developing the counting process. When the children have completed the development, they should be aware of more of the concepts involved in counting than just the simple recitation of a sequence of counting words. Two stories, "Ugboo's Big Problem" and "Tal's Aching Back," illustrate this development of counting.

Another story, "Ruth Ann and the Number Names," makes the point that numerals, which are number names and their written symbols, are arbitrary and depend on social agreement. The children should become aware that numbers have meaning beyond language or written notation. The numerals from 0 through 20 are taught by rote and established by much practice. Probably most children will be ready for the concepts of decimal place value and numbers to at least 100 when these are presented in Section 5 of Unit 11.

As the sequence of numerals is learned, it is shown that each counting number is formed by adding one to its predecessor. The children order sets by the number of members they contain. By pairing of set members, the children develop a feeling for the meaning of "fewer than" and "more than" in terms of sets.

NOTES ON TEACHING THIS UNIT

The unit is divided into four sections, each of which emphasizes a particular topic. The sections are divided into lessons, most planned to take approximately one class period. It is expected that generally two periods a day will be used for MINNEMAST material. You may choose to teach this unit alone; or you may choose to do one lesson from it and one from Unit 8 each day, starting any time after Section 2 of Unit 8 has been completed. If it is taught alone, Unit 9 should be completed in about 3 or 4 weeks. Children without the background of the MINNEMAST kindergarten materials may need more time to complete the unit.

In some lessons questions are printed in capital letters. These should be considered as guides to the questions that will be asked, not as required questions. Similarly, the printed answers are not the only acceptable replies.

NOTES ON MATERIALS

Counters, which are used in many lessons, may be any small, easily available objects. Examples are paper disks, pebbles, paper clips, pennies, checkers, pegs, plastic figures, and blocks. Don't forget that fingers are always available if ten or fewer counters are needed.

It would be fun for the children if the counters were sometimes attractive objects such as flowers, leaves, or shells. It is desirable that the same type of counter should not always be used in a single set, e.g., checkers and paperclips.

Minnebars are used in this unit. Minnebars are small wooden bars which are cut in integral numbers of units of length; that is, a four-unit bar is four times as long as the unit length chosen as a standard. To help the beginner, the bars of a particular length are colored alike. In this unit the bars are used particularly to establish order relations among numbers.

SECTION 1 ONE-TO-ONE CORRESPONDENCE

PURPOSE

This section shows or reminds the children that

- the numbers of members in two sets can be compared by one-to-one pairing without counting,
- the result of comparing the numbers of members in two sets is not affected by rearranging either set or substituting a new member for an old member,
- a reference set can be constructed when two sets can't be directly compared,
- the order relation is transitive; e.g., if you know that the first set has more members than the second set, and the second set has more members than the third, then you also know that the first set has more members than the third set.

COMMENTARY

Sometimes the numbers of members in two sets can be compared by direct pairing of the members without counting. If the two sets contain the same number of members, it is possible to pair each member of the first set with a member of the second set with no "leftovers." If either set has members left over after all possible pairs have been formed, that set has more members and the other set has fewer members. We also say that the one set has a greater number of members and the other has a lesser number of members. These ideas should be made explicit to the children by asking them, after two sets have been compared, which set has more members and which has fewer members.

The story of "Ugboo" introduces the problem of comparing sets that are separated in time or space so they can't be directly compared. "Ugboo" used a set of stones as a symbol

for the number of members in his first set, his flock of sheep. He did not have a set of number names with which to pair members of his set of sheep so that he could count them.

Lesson 1: ONE-TO-ONE COMPARISONS

This lesson uses the idea that the numbers of members in two sets can be compared by direct pairing of the members. Changes in the sets being compared are introduced. Some of these changes, such as the rearrangement of the set, do not change the results of the comparison; and some, such as adding members to one set, do change the results.

Activities similar to the suggested ones can be done at various times during the day as well as in a MINNEMAST class.

MATERIALS

— about 40 of each of two kinds of counters

There will be better motivation for activity A if the sets compared are collections made by the children rather than counters provided by the teacher. Any collection of an appropriate size can be used; e.g., a set of about 40 baseball cards. However, sets of natural objects are especially desirable. Some interesting examples are: two kinds of rock pieces (granite and sandstone); pebbles rounded by water and sharp rock chips; two kinds of seeds, nuts, leaves, shells, or preserved beetles.

PROCEDURE

A. Show the class two sets of counters, about 40 of each. Use a large number of objects in each set to discourage immediate counting and identification of the greater set. We will suppose here that the counters are paper clips and checkers. Ask the children whether there are more clips or checkers. Ask for suggestions for finding out. Often children will suggest counting both sets. When this suggestion is made, remind them that the counting will be difficult and may not be accurate because the sets are large and it will be hard to keep track of the set members already counted. If the children still wish to count, let several children count. Record the results. Whether the counts agree or disagree, ask if they can think of a method of showing which set contains more members without counting all of the members. A

child may suggest, perhaps with a little prompting, that the sets be paired in a one-to-one manner. Select a few children to perform the pairing. When at least one of the sets is used up, ask questions similar to the following:

WHICH SET HAD LEFTOVER MEMBERS?

ARE THERE MORE PAPER CLIPS OR CHECKERS?

WHICH SET HAS THE GREATER NUMBER OF MEMBERS?

WHICH SET HAS THE LESSER NUMBER OF MEMBERS?

Rearrange the sets so that one set covers more space than the other. Ask the children which set now has the greater number of members. If there is any uncertainty in the responses, repeat the pairing as done above.

B. When all the people in the room are seated, ask the children to compare the number of people with the number of chairs in the room.

ARE THERE LEFTOVER CHAIRS?

WHAT DOES THIS TELL YOU? (If there are leftover chairs, there are more chairs than people.)

Ask the children to predict the result of comparing the number of people and chairs if one chair were exchanged with one from another room; if one chair were placed in a different part of the room; or if some of the people got up and then sat down in different chairs. (In all these cases, the number of pairs does not change.) In each case they should be aware that the results depend on whether or not there are unpaired chairs remaining when everyone has been seated.

C. Fingers should be compared to sets of ten or fewer members. For example, compare the number of fingers on the right hand with three pieces of chalk.

Try to have all the children see that the reason there are more fingers than pieces of chalk is that there are unpaired fingers remaining.

D. The number of coats can be compared with the number of hooks.

ARE THERE LEFTOVER HOOKS?

ARE THERE MORE COATS OR HOOKS?

If everyone has a coat, have the coats put on.

ARE THERE MORE HOOKS OR CHILDREN?

The answer to this questions can be checked by having each child put a hand on a hook. The comparison of the number of children to the number of hooks by comparing each to the number of coats is a forerunner to the use of a reference set "discovered" by Ugboo in Lesson 4.

Lesson 2: ESTIMATING LARGER NUMBERS

This lesson uses one-to-one correspondence to compare large numbers. Although this program has not as yet introduced numbers beyond ten, many children can count to much greater numbers. This lesson allows these children to count and also shows them the usefulness of one-to-one pairing. If your children can't count well enough for part B now, use it later.

MATERIALS

— corks (about 60 from Unit 12)

— checkerboard

— 34 red and 34 black checkers

PROCEDURE

A. Take a double handful of corks (about 30) and show them to the children. Ask a child to pick up an approximately equal number of corks.

WHICH SET OF CORKS HAS MORE MEMBERS?

HOW CAN WE TELL? (Pairing the corks in the two sets.)

Any children who wish should count the sets.

B. Place the checkerboard so all can see. This may require having the children in small groups or using an overhead projector. Put down 28 red checkers on red squares. Ask the children to count as you put them down.

ARE THERE MORE OR FEWER RED SQUARES THAN RED CHECKERS? (There are as many red squares covered by a checker as there are checkers plus the leftover uncovered red squares.

Clear the board. Put down black checkers, one at a time, with the children counting. Cover all the black squares and two of the red squares.

HOW MANY BLACK CHECKERS ARE THERE? (34)

ARE THERE MORE OR LESS THAN 34 BLACK SQUARES? WHY? (Less, because when all the black squares are covered with black checkers, there are still two more black checkers.)

Repeat the above procedure, but this time ask,

ARE THERE MORE BLACK CHECKERS OR BLACK SQUARES? WHY?

Clear the board. Cover the board with red checkers on red squares and black on black. Do this rapidly and in random order to keep the children from counting them as you place them. Ask for suggestions for methods of finding whether there are the same number of black and red squares. If counting is suggested, let them try. This may show the difficulty of keeping track of a large number of objects. What else could be done? (The checkers could be picked up and paired: one red, one black.)

Lesson 3: SETS WITH FEWER AND MORE MEMBERS

This lesson provides more experience with the concepts of one-to-one pairing, more, and fewer.

MATERIALS

- Worksheet 1
- 20 counters
- 20 paper cups
- empty box or bag

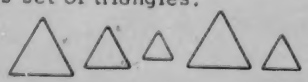
for each team playing the game:

- 20 or 30 counters
- 1 special die marked as required by the game, or 2 regular dice

PROCEDURE

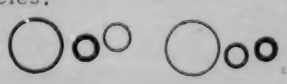
Worksheet 1
Unit 9 Name_____

Draw a set with the same number of members as this set of triangles.



Draw a set with more members than this set of squares.

Draw a set with fewer members than this set of circles.



A. Have the children complete Worksheet 1. Those who have difficulty should use activity B and the game in C.

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B. Set out 20 cups and 20 counters where the children can see them. Ask them whether there are more cups or counters and how they could find out without counting.

Have one child do the pairing by putting one counter in each cup and then ask,

ARE THERE MORE CUPS THAN COUNTERS?

ARE THERE MORE COUNTERS?

ARE THERE THE SAME NUMBER?

Have another child pour the counters from the cups into a previously empty bag or box.

ARE THERE MORE CUPS, MORE COUNTERS, OR THE SAME NUMBER?

HOW DO YOU KNOW?

In the discussion you should point out the assumption that in the transfer no counters were lost.

Substitute counters for some of the ones in the box in a one-to-one manner. Take one counter out of the box and replace it with a different counter (perhaps of a different color or size). Do this several times.

ARE THERE MORE CUPS, MORE COUNTERS, OR THE SAME NUMBER OF EACH?

HOW CAN YOU FIND OUT? (By pairing the new set of counters with the cups.)

Now add a counter to the box without removing one. Ask them to predict the result of pairing counters and cups now. Do the pairing.

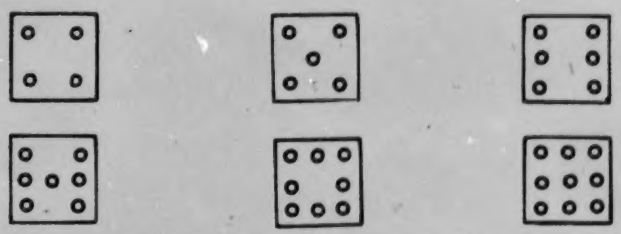
WHAT DOES THE LEFTOVER COUNTER TELL YOU? (That there are more counters.)

Now take away a few counters from the box and ask about the comparison. Do the pairing.

WHAT DO THE UNPAIRED CUPS MEAN? (That there are more cups and fewer counters.)

C. This game provides additional practice with the concepts of one-to-one correspondence.

The children play in pairs. Each pair should have 10 counters for each player and a special die or 15 counters and two ordinary dice. The special die is made by marking the sides of a wooden cube with from 4 to 9 dots. It is suggested that the dots be shown in regular patterns, e.g.,



The first player tosses the die. The second player matches the dots shown on the die with counters from his pile. The matched counters are then given to the first player.

The second player now tosses the die. The first player matches counters to the die and gives them to the second player. Play continues until one player does not have enough counters to match the dots on the die.

Variations: Three or four children may play, with the child to the left of the thrower matching the dots on the die. The players take turns around the circle until only one child has counters left.

The child must produce a set of counters with one more (or one less) than the set of dots on the die.

Lesson 4: STORY: "UGBOO'S BIG PROBLEM"

This lesson uses a story to introduce the idea that two sets can be compared by comparing each to a third set. For example, the number of sheep going to pasture in the morning can't be compared with the number of sheep returning in the afternoon by direct pairing of the two sets of sheep. But it is possible to pair directly the set of sheep in the morning with an equivalent set of stones. This reference set of stones can be paired in a one-to-one manner with the sheep in the evening. If this pairing comes out even, the number of sheep is the same in the evening as in the morning; if there are unpaired stones or sheep left over, the number of sheep has changed during the day.

Although some of the children will have heard the story in kindergarten, they should now be able to understand more fully the concepts in the story. Therefore, use the story for all children regardless of whether they have heard it before.

MATERIALS

— Story booklet

PROCEDURE

Read the story, "Ugboo's Big Problem" to your class, pausing for the suggested activities. Explain to the children that it is a story and that Ugboo was not a real person.

Send home a story booklet with each child.

UGBOO'S

BIG PROBLEM

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Minnesota Mathematics And Science Teaching Project

UGBOO'S BIG PROBLEM

Here is Ugboo. He lived a long, long time ago. This is the way he counted: "One -- two -- many." He did not know any other way to count more than two. At that time no one knew how to count more than two.

Ugboo had a job. He watched sheep. He watched the sheep of the whole tribe. Every morning he would let them out of the fold (sheep pen). He would take them to a grassy place. Ugboo had to watch the sheep while they ate grass. He had to keep his eyes open because the lions and the wolves liked to eat sheep. They would steal sheep and eat them if Ugboo wasn't looking. At night Ugboo would take the sheep home and put them into the fold again.

One evening when Ugboo came home with the sheep, the chief of the tribe met him. The chief's name was Zarathustra. In those days the chief of the tribe always had a long name to show that he was important. Zarathustra looked at the sheep. He said, "Are these all the sheep of the tribe? Don't you have more?"

Ugboo answered, "These are all the sheep of the tribe. They are the same sheep we had this morning."

Zarathustra said, "There don't seem to be as many sheep. Did you fall asleep today while you were supposed to be watching them? I think you did."

Ugboo began to cry. "I did <u>not</u> fall asleep. I kept my eyes open all the time."

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Zarathustra was angry and shouted, "I think you fell asleep and a wolf or a lion stole some sheep. It looks as though there are fewer sheep than there were before. If you lose any more sheep, I will punish you, Ugboo! The tribe needs the sheep for wool, skin, and meat." Then the chief went away.

Ugboo was very sad. He said to himself, "How can I be sure that there are as many sheep now as there were before? How can I show big chief Zarathustra that I did not lose any sheep? There were many sheep before and there are many sheep now. How can I, or anyone else, tell the difference between many sheep and many sheep?"

Ugboo was afraid of Zarathustra. The chief was the biggest and strongest man in the tribe. All the others were afraid of him, too. Ugboo did not want Zarathustra to punish him.

Ugboo thought and thought. He thought all evening about his problem. At supper his mother said, "Ugboo, why are you so quiet? On other nights you chatter all the time."

"I am thinking," Ugboo answered. Then he told his mother about his problem.

She said, "You are wasting your time. Everybody says, 'one -- two -- many,' and that's all there is. More than two is many. But now let's stop and eat. Here's a stone knife and a big piece of deer meat. Cut off a small piece for each of your brothers and sisters."

Ugboo did as his mother told him. He began to cut the meat and said, at the same time, "One piece for brother Nip, one for sister Snip, one for sister Snap, and one for little Norum." Then he carried the meat to the other children and gave one piece to each one. He gave himself a piece, too.

While they were eating, Ugboo said to himself, "One piece of meat for each child, one child for each piece of meat. No children left over. No pieces left over. There are just as many pieces of meat as children and just as many children as pieces of meat."

Suddenly he felt as though a light had lit up in his head. He felt as though he had been in the dark until now.

He jumped up and yelled, "I've got it! I've got it!"

His mother asked, "What have you got? A stomach ache?"

Ugboo said happily, "I know how to find out whether there are fewer sheep at night than in the morning. I know! I know!"

What answer do you think Ugboo found to his problem?

Let the children make suggestions.

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Ugboo cut the meat and said, "One piece for brother Nip, one for sister Snip, one for Sister Snap, and one for little Norum.

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As soon as Ugboo woke the next morning, he went to the edge of the lake near his cave. He took with him a sheepskin bag which his mother had made for him. He began looking for little stones and pebbles on the shore. He picked up every one he found, and put it in his bag. When the bag was full, he threw it over his shoulder and carried it to the sheep fold. He emptied the bag on the ground, and then let the sheep out of the fold, one at a time.

As each sheep left the fold, Ugboo put one pebble in the bag. Then he led the sheep to the big chief, Zarathustra.

"What do you want?" growled the chief.

"I want to give you this bag of stones," said Ugboo. "There is one stone in this bag for each sheep in the flock and one sheep for each stone. There are just as many stones as sheep. You can see for yourself."

The chief went back with Ugboo and began pairing the stones with the sheep. Sure enough, there was one stone for each sheep and one sheep for each stone.

Zarathustra muttered to himself. "Let's go over this again very slowly. I want to be sure -- really, really sure I understand this. Let me see. If there is one stone for each sheep, then there are at least as many stones as sheep."

He sat down and wiped the sweat from his forehead. He said to Ugboo, "This thinking business is hard work. I'm tired already -- I had better rest awhile."

After a few minutes he said, "Where was I? Oh, yes. There are at least as many stones as sheep. But there might be more stones than sheep. We might have one stone for each sheep, and still have some stones left over. Let us look. Are there any stones left over?"

Zarathustra started to look to see whether there were any stones left over. Ugboo reminded him, "Don't you remember, chief? There is one sheep for each stone. So there can't be any stones left over."

Zarathustra was puzzled. He wrinkled his eyebrows and thought. He thought very, very hard. Suddenly he began to smile.

"That's right!" he said. "That's absolutely, positively right! It is hard to think of all these things at one time. But once you do put it all together, it is really easy to see. Since there is one stone for each sheep, there are at least as many stones as sheep. Since there is one sheep for each stone, there are at least as many sheep as stones. As many stones as sheep . . . as many sheep as stones . . ." He looked from the stones to the sheep, to the stones, to the sheep, thinking.

"This thinking business is hard work . . . I had better rest awhile."

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Suddenly he pounded one fist into the palm of his other hand and shouted, "Of course! There are just as many stones as sheep!"

Then he turned to the boy and asked, "What of it? Why are you taking up my whole morning with all this stuff? Why haven't you taken the sheep out to the grassy place yet? They must be hungry already."

Ugboo answered, "Don't you see? When I bring the sheep home tonight, you can pair the stones with the sheep again. You can put down one stone for each of the sheep. If there are no stones left over, then you will know that I have brought back all the sheep. If there are some stones left over, you will know that I have lost some sheep, and you can punish me."

Zarathustra said, "How is that again? If there are some stones left over, then . . . Let me think it over . . . Oh, don't bother me any more! Go tend your sheep right now, or I won't wait until tonight to punish you. Get going. Scoot! I have to go hunting. Do you think I have all day to talk to little boys?"

Then Zarathustra went hunting with some of his friends. During the hunt, he told the other men about what happened. "You know that boy, Ugboo? He came to me this morning with a long story about stones and sheep."

The chief began explaining to the men about one stone for each sheep and one sheep for each stone, but -- wouldn't you know -- he got it all mixed up! "I'm sure I understood it this morning," he said. "Now I am so dizzy, I am not sure of anything. Let's hunt now and talk about it at supper tonight."

During the hunt, Zarathustra told the other men about what had happened.

That night the chief talked it over with all the other leaders in the tribe. They were sitting around the fire in a circle, each one eating a chunk of meat he held in his hand, and they were arguing.

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Finally, the chief said, "Let's call Ugboo," and he pulled Ugboo into the circle of men. "Explain what you told me this morning, Ugboo," he said.

Ugboo began to tell, slowly and shyly, how he had cut up the meat for his brothers and sisters. "There was one piece of meat for each child and one child for each piece of meat," Ugboo began, "and none left over."

"We don't want to hear about that," the chief said. "Tell the men about the sheep and the stones!"

"Well, the meat gave me the idea," Ugboo said. "I thought if it would work for the children and the pieces of meat, I might be able to pair each sheep with something, too. Then I thought of the stones. I collected a lot of stones and put them in this bag my mother made for me. When I went to the sheep fold this morning, I dumped all the stones on the ground. Then, for every sheep that came out of the fold, I put one stone in the bag. There were just as many stones in the bag as there were sheep -- one stone for one sheep.

"And tonight, when I brought the sheep back to the fold, I took a stone out of my bag each time a sheep went in the gate. When all the sheep were back in the fold, my bag was empty. There was exactly one stone for every sheep -- just as there had been in the morning. There were no sheep left over and there were no stones left over. That's how I know I brought back just as many sheep tonight as I took out this morning."

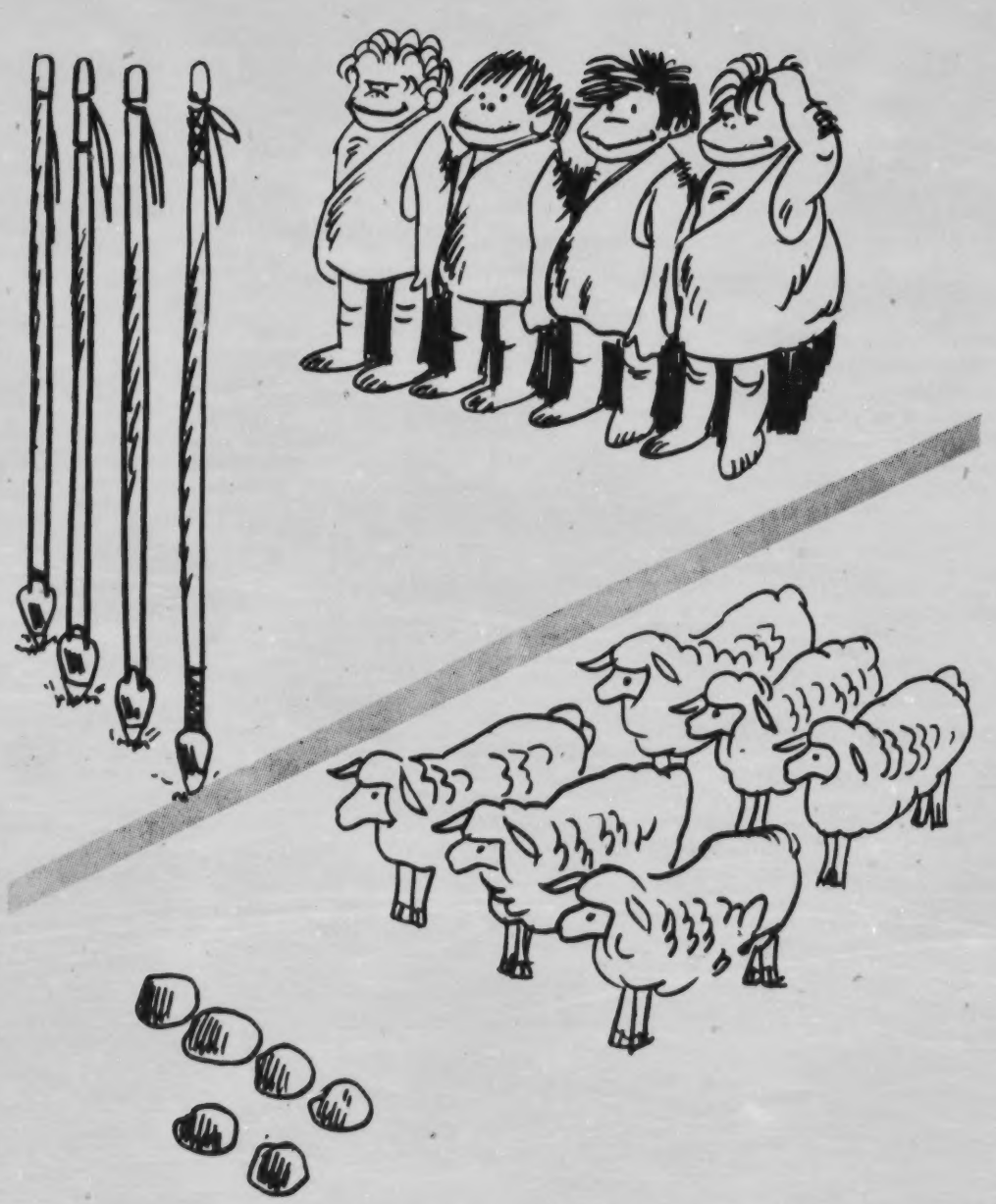
When Ugboo finished, all the men were quiet for a while, thinking. Then they began to ask questions.

"Would this work with other things, too?" one of the men asked. "If there is one spear for each man, and one man for each spear, then are there just as many spears as men?"

Another man asked about people and noses. Another one asked about knives and bones.

At last Zarathustra said, "This is a wonderful discovery and I have thought of another way to use it. If we have two sets and want to know which one has more in it, all we have to do is pair one thing in the first set with one thing in the other. We keep on matching one for one. When we are done, if there are any left in one set, then we know that that set has more. If there is nothing left over in either set, then there are just as many in one set as in the other."

All the men agreed that this was a very good idea. One of the men said, "Ugboo is a very clever boy. We ought to do something for him." The others said, "Yes, he deserves a reward."



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Then the big chief, Zarathustra, said to the boy, "We are going to give you a great honor. We are going to give you a name just as long as the big men have. Then everyone will know that you are a very important person. From now on, we will call you 'Uggabugaboo'."

Uggabugaboo's mother and brothers and sisters all ran up to him and hugged and kissed him. His father patted him on the back and shook hands with him. No other boy in the whole tribe had ever had such an honor.

When he grew up, Uggabugaboo became a very big chief himself. Then he was called Uggabuggabuggabuggaboo. He was really important then.

Historical basis for the theme of Ugboo's Big Problem is to be found in a book by Richard Starr, Nuzi: Report of the Excavations at Yorgan Tepa, near Kirkik, Iraq (Harvard University Press, 1939). The report notes the finding of "a large number of inscribed clay texts, one of which was the extraordinary tablet of 'Zikarri the shepherd'." Roughly egg-shaped and hollow, with a hole at its pointed end, it bears the inscription "stones of the sheep" followed by a list of animals given to "Zikarri the shepherd," presumably for grazing. Inside the tablet were forty-nine pebbles.

To Parents:

Your child is now using MINNEMAST Unit 9, Numbers and Counting, which deals with an understanding of the concept of number. Children are often able to recite a long list of numerals correctly, but frequently have little notion of the number each numeral represents. When these lessons have been completed, the child should be able to count to 20 with understanding and be able to read, write and order the numerals 0 through 20. Many more ideas are involved than the rote recital of the counting words.

The story "Ugboo's Big Problem" tells of the comparison by one-to-one pairing of a set of sheep and a set of stones. In class, the children do one-to-one pairings with a variety of objects. This idea is basic to the concept of number.

Later, the children will hear another story which shows that they can determine the number of objects by pairing each object with a number word. This is counting.

You can help your child by encouraging him to make pairs of objects whenever the opportunity arises. If he helps you set the table, he pairs a plate with each chair and a fork with each plate, etc. Later, it is important that he be able to pair one word of the counting sequence with each object of the set he is counting.

Lesson 5: USING "UGBOO'S" DISCOVERY

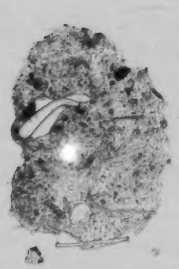
This lesson is a follow-up to the "Ugboo" story.

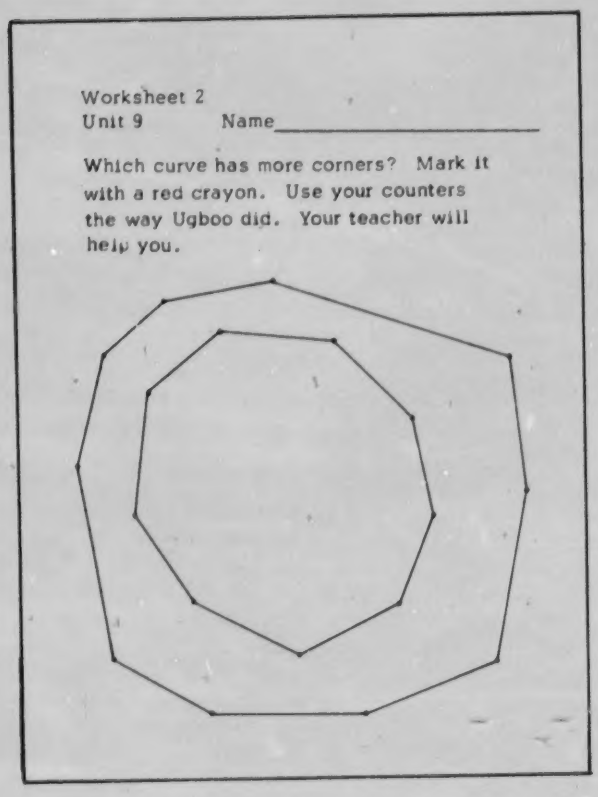
MATERIALS

- about 12 counters for each child
- Worksheet 2

ACTIVITIES

A. Following the reading, a dramatization of the story can reinforce the ideas presented. Have one child be "Ugboo," one "Zarathustra," and the rest sheep. Have Ugboo put a stone (or substitute) into a bag (or box) as each sheep goes out of the fold and take a stone out of the bag as each sheep later returns to the fold. Some sheep may hide, pretending they are lost. When it is discovered that there are stones for which no sheep appear, ask questions such as, "Are there more stones than sheep? Are there fewer sheep now?" "Ugboo" should search for the lost sheep.




Worksheet 2
Unit 9 Name_____
Which curve has more corners? Mark it with a red crayon. Use your counters the way Ugboo did. Your teacher will help you.

B. Worksheet 2 makes use of a reference set of counters. Have each child place Worksheet 2 and a supply of counters on his desk. Explain that they are to find which curve on the worksheet has the greater number of corners. Suggest that one counter be placed on each corner of the inner curve. Have any remaining counters put away.

HOW CAN YOU USE THE SET OF COUNTERS ON THE CORNERS TO FIND OUT WHETHER THE OUTER CURVE HAS MORE CORNERS? (Place the counters on the corners of the outer curves. Since there are leftover corners, there are more corners on the outer curve than on the inner curve.)

SECTION 2 TALLYING, COUNTING AND READING NUMERALS FROM 0 TO 20

PURPOSE

This section contains lessons which

- review and extend tallying, number names and numerals from 0 to 20,
- provide practice in writing numerals,
- reinforce the concept of number from 0 to 20.

COMMENTARY

The "Tal" story and associated activities which introduce Section 2 will help the children understand that counting is essentially a matter of pairing. When a set is counted, its elements are paired in one-to-one fashion with the number names (a set of words in a given sequence). The last number name to be paired gives the number of members in the set. Any set of ordered words can serve the purpose of counting. This is demonstrated in Lesson 7 by having the children count by using a set of number names in a foreign language.

Before the children are ready to use written numerals, they will need to know the numerals in proper sequence and be able to identify the number of members in a set with a numeral. Lessons 8 through 13 provide a review of the numerals 0 through 20 and supply practice in counting. Many small children are unable to count accurately any but the smallest sets, even though they can recite many number names in order. Activities in these lessons are designed to help them attain reasonable facility in counting and assigning numerals to sets. Your children may not need to do all the suggested activities. Use your judgment about which activities to include, and present any given activity to the whole class, to small groups, or to individual children as you feel advisable.

Lesson 6: STORY: "TAL'S ACHING BACK"

Before reading "Tal's Aching Back" to the children, explain that no one knows how counting started. Although people certainly didn't learn to count all at once, they did learn it little by little. In spite of the uncertainty about the origin of counting, it is fun to pretend that some children invented counting for their tribe. "Tal's Aching Back" is a "made-up" story about such children.

Read the story and show the pictures to your class, and ask for class predictions at the indicated places. You may wish to read the story in two parts. A follow-up discussion should bring out the following ideas. Sometimes two sets to be compared cannot be brought together. (Perhaps the sets are the set of sheep in the morning and the set of sheep in the evening, or perhaps they are the set of goats on one mountain and the set of goats on another mountain.) Then a set of tally marks can be used to compare and keep track of how many are in the sets. Or, instead of tally marks, a set of number words such as "one," "two," "three," ..., can be used. The words can be paired in order with the members of any set. The last word paired tells how many members are in the set. This is called counting.

Ask for suggestions for ways to make tally marks other than by making scratches on a stick.

TAL'S ACHING BACK

TAL'S ACHING BACK

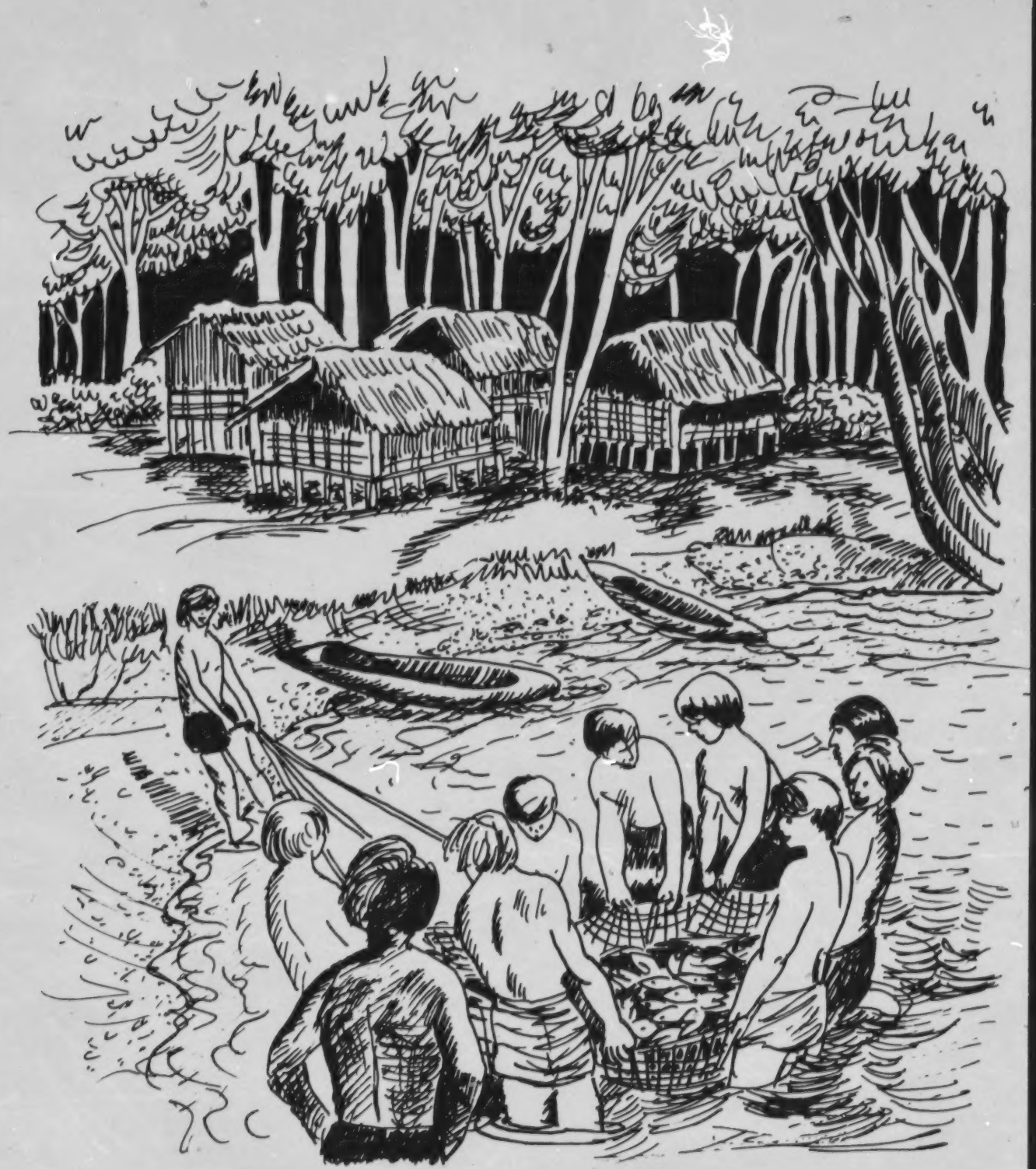
Tal was Ugboo's great-great-great-great-grandson, which means Tal lived many years after Ugboo. By this time everyone in Tal's tribe had learned about Ugboo and his great invention. Everyone carried around a little sheepskin bag of stones. Whenever anyone wanted to compare sets that were far away from each other, he would match a stone with each member in the first set. Then he would carry these stones to the other set and match each of the stones with a member in the second set. In this way it was easy to find out which of two sets had more members than the other.

Since the people in Tal's tribe lived by the shore of a lake, they often caught fish for food. Very often they had more fish than they needed for themselves.

The people also hunted for food with bows and arrows. But the right kind of stone for the arrowheads could not be found near the shore of the lake. So when the people in Tal's tribe had extra fish, they would trade with another tribe and receive arrowheads in exchange.

One day Chief Vishtapaka came to Tal and said, "We have a lot of extra fish. Put them into a big sheepskin bag and take them over to the Annuki tribe on the other side of the hill to trade for arrowheads. Be sure that you get enough arrowheads to give one to each hunter in our tribe."

Tal put the fish in a large sheepskin bag. Then he put one stone for each hunter in his tribe into another bag. There were many hunters in the tribe, so there were many stones in the bag. Tal put the bag of fish over one shoulder and the bag of stones over the other shoulder and started up the hill.



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It was a hot day and the sun beat down on Tal's head. By the time he reached the top of the hill, he was hot and tired and sweaty. He sat down and rested before going down the other side of the hill. When Tal reached the bottom, he went to the chief of the Annuki tribe and said, "My chief, Vishtapaka, has sent me to trade these fish for arrowheads. He wants one arrowhead for each stone in this bag."

After Chief Darayavush of the Annuki tribe agreed to make the trade, Tal emptied his bag of fish, took the stones from the other bag and placed them neatly on the ground. Chief Darayavush then put one arrowhead next to each stone. When the trading was finished, Tal placed the arrowheads in the large bag in which he had had the fish and began his long climb back up the hill to go home to his own tribe.

In the afternoon, the sun felt even hotter than before. The bag of arrowheads on Tal's shoulders seemed very heavy. By the time he came down the other side of the hill, his back and shoulders felt very sore indeed. He stumbled into the camp and let the bag of arrowheads slip down to the ground. "Here are the arrowheads, Chief Vishtapaka," he said wearily. "There is one arrowhead for each hunter in the tribe." The chief was very pleased and gave Tal a friendly clap on his back.

"Ouch, my aching back!" moaned poor Tal, as he went to find some shade under a big tree.

As he was resting, his friend, Ningal, came to him. "Tal, why are you lying there?" she asked.

Tal sighed, "I have been carrying fish and arrowheads and stones all day."

"Why?" Ningal asked.

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"Because I had to trade fish for arrowheads. I had to get one arrowhead for each hunter, so I took along one stone for each hunter to tell me how many hunters there were."

Ningal felt sorry for Tal. She said, "There must be some better way to keep track of how many hunters there are than by carrying around a heavy bag of stones."

They sat there, thinking. Then Tal began playing with a stick and a sharp rock. Without thinking he made a row of scratches on the stick.

Suddenly Ningal jumped up. "I have a wonderful idea. You could carry something that wasn't so heavy as a bag of stones."

WHAT SET DID NINGAL THINK OF FOR TAL TO CARRY?
("Marks on a stick." But go on with the story rather soon, even if no one suggests this answer.)

"You could make a mark on the stick for every hunter and then carry the stick over the hill to the Annukis."

Tal shouted, "Wonderful! Then when I arrived there, I could ask for one arrowhead for each mark. That would be the same number of arrowheads as I got for my stones. One arrowhead for each stone -- one arrowhead for each mark -- one mark for each hunter! And my back wouldn't be so sore."

Tal and Ningal explained to the other people in the tribe their new way of comparing sets. Everyone found it much easier to match tally marks with the members in a set than to carry around all those heavy stones. They called their new method "tallying."

Stop here, if reading the story at two separate sessions.

Many years later Tal's great-great-great-grandson, a boy named Nat, was sitting with Zelona, a girl of the tribe, on a small hill overlooking the village.

"My grandmother told me that long ago the tribe carried bags of stones to help them compare sets," Nat said. "Sticks with tally marks are certainly a lot easier to carry, but they still are a lot of trouble."

"Yes," Zelona said, "making the marks on the sticks takes a lot of time, and yesterday my friend Tanana dropped her tally stick over the cliff. Then she didn't know how many fish her mother wanted her to bring home."

"Is there something else that would be easier to make and easier to carry?" Nat wondered.

As Nat sat there thinking and rubbing his fingers over the tally marks scratched on a stick, Zelona suddenly pointed down towards the village and said, "Oh, look! The herdsman is bringing your grandfather's goats back to the village."

But Nat didn't look up and still sat there thinking and rubbing his fingers over the tally marks.

"Aren't the goats beautiful?" Zelona went on. "And I know the name of each one. There goes Kunye, Beli, Tatu, Kune, and Hlanu."

"Zelona!" Nat exclaimed. "We can match words with the tally marks! Every time I felt a mark, you said a name. We could carry a list of words in our heads. Then to find out how many fish we had, we could pair each fish with a different word."

"That sounds like a good idea," Zelona said. "But we don't have any names for the tally marks."

"Since it was the names of the goats that gave me the idea," Nat said, "why not give the tally marks the same names as the goats?"

And this is what they did. They named their tally marks "kunye, beli, tatu, kune, hlanu, tupa, bathu, ngulu, danisa, and bumda."

THIS WAS THE LANGUAGE NAT AND ZELONA SPOKE.
WHAT DO YOU THINK THE ENGLISH WORDS MIGHT BE?
(One, two, three, four, five, six, seven, eight, nine, ten.)

After they had figured out the number names, Nat said, "Let's see if pairing these words really works. I'll say some of the words while you get a stone for each word. Then you say the same words while I get a stone for each word. Then we'll see if we each have the same number of stones."

Nat said the goat names for "one, two, three, four, five, six," while Zelona put down a stone for each word. Then Zelona said the words and Nat put down the stones.

Have two children do this.

"Do our piles really have the same number of stones?" Zelona asked. "How can we tell?"

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HOW DO YOU THINK THEY COULD TELL?
(One-to-one pairing will show that the sets contain the same number of stones.)

"We can pair the stones," Nat said. "We will take one from your pile, one from mine."

Show Picture 5, Nat and Zelona pairing six stones.
Have two children pair the sets formed above.

After they had matched their sets of stones, Zelona called out happily, "They do have the same number! We can use number names instead of tally sticks!"

Nat and Zelona explained their system to the older people of the tribe. They then taught the other people the list of number names.

On the next trading trip for arrowheads (after they had memorized the number names), the men tried the new method. They liked it very much. The men paired one word with each arrowhead they needed. The last word they said told them the number of arrowheads. They called this method "counting." Of course, they had to remember to say the words in the same order each time or it wouldn't work. Until they got used to this method, they often got all mixed up.

Because there were more than ten members in some sets, the tribe had to invent more number words.

WHAT WORDS COULD BE USED AFTER TEN?
Let the children count as far as they wish.

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Lesson 7: TALLYING PRACTICE

This lesson suggests activities that will give the children practice in keeping track of the number in a set by tallying. Use the activities suggested here or others that you may prefer. Care must be taken to provide experiences where tallying is useful and not an unnecessary chore.

MATERIALS

— Minnebars

ACTIVITIES

A. Score keeping in games is one of the most natural uses of tallying. Opportunities for keeping score will arise in this unit and throughout the year.

B. Tally the absences in the class each day for two weeks. Then the week with the greater number of absences can be found by comparing the tally sets.

C. If you have Minnebars of different scales available, have the class compare bars from the two sets. For example, the 9 unit bar of one size will be longer than the 10 unit bar of the other size; but by making a tally for each unit, the class can see that the 10 unit bar contains more unit lengths.

D. Later, when the children are counting quite large numbers of objects, tallies can be useful to keep track of the sets. For example, in Lesson 20, tallies are suggested for those who have difficulty with Worksheet 6, 7, or 8.

E. Read a poem or sing a song which repeats certain words or phrases. Ask the children how many times a certain phrase was repeated, and then ask whether they could devise a method to find out. (You might have one child make a tally mark on the board each time the phrase is said. The result should be checked by having another child cross off the tally marks when the poem is repeated.)

Lesson 8: GROUPING SHELLS

In this lesson the children will classify sets of shells by two properties -- shape and color. The children will find different subsets of the shells and will discover that shells can belong to more than one subset. These activities review parts of Unit 8.

Another purpose of the lesson is to introduce tallying as a useful procedure for representing and comparing the numbers in sets and subsets.

MATERIALS

for each child:

— one set of at least 6 shells consisting of white scallop, yellow conch, and white conch

— 2 18-inch lengths of yarn or string: white and blue

PROCEDURE

After eliminating shells that are badly broken, spotted or streaked, distribute a set of at least 6 shells to each child. This set should have at least one of each of the three types of shells.

Ask the children to examine the properties of the shells and describe them to the class. You may list a few of those on the chalkboard. Ask pupils, when considering the property of color, to overlook streaks and spots on the shells and consider only the major color. Ask for descriptions of the two different shapes of shells. If no one suggests suitable adjectives for the shapes, ask that the conches be referred to as "curly-shaped" and the scallops as "fan-shaped" -- as is done in this lesson.

Now have the children separate the shells on their desks by color. The children should work alone on this part of the activity, trying different ways to arrange the shells. You may need to guide some individually.

When they have made their arrangements, point out that they now have two subsets of shells -- a subset of white shells and a subset of yellow shells. Have them mix the shells again, and ask

IS THERE ANOTHER WAY TO DIVIDE THE OBJECTS INTO JUST TWO SUBSETS? (By shape.)

If no child volunteers an answer, remind them of the shapes mentioned in their descriptions. Then have the children group their shells again into the new subsets according to shape -- curly and fan-shaped. Ask the children to name these two new subsets.

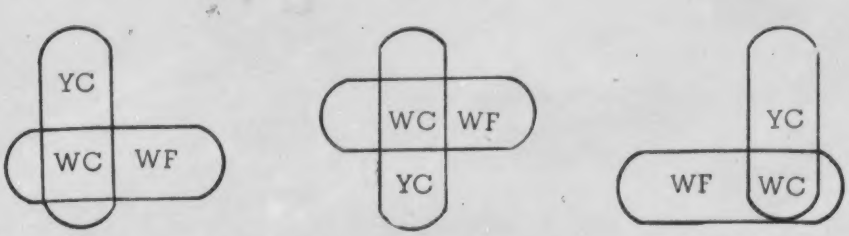
Now ask the children to separate each of these subsets according to color.

HOW MANY SUBSETS DO YOU HAVE NOW? (3)

NAME THEM. (Yellow curly, white curly, white fan-shaped.)

After giving the children the blue and white lengths of yarn, ask them to use the white yarn, first, to make a curve surrounding <u>all</u> the white shells on their desks. Then have them form a curve with their blue yarn around <u>all</u> the curly shells. In this portion of the lesson, it is very important that you give the children time and freedom to think about the problem and to solve it in their own way. There are many possible ways to arrange the shells and yarn so that the white curly shells are within both curves. Some may look like these.

WF = White fan YC = Yellow curly WC = White curly



When all the children have made some satisfactory arrangement of their shells and yarn, ask some questions similar to the following.

WHAT COLOR YARN IS AROUND YOUR WHITE FAN SHELLS? (White.)

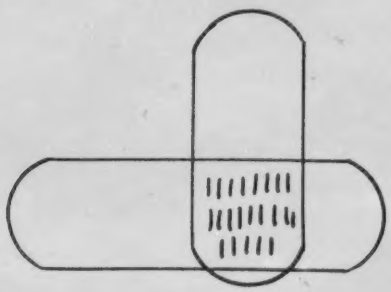
WHAT COLOR YARN IS AROUND YOUR YELLOW CURLY SHELLS? (Blue.)

WHAT COLOR YARN IS AROUND YOUR WHITE CURLY SHELLS? (White and blue.)

WHY DO THE WHITE CURLY SHELLS HAVE BOTH COLORS AROUND THEM? (They are both white and curly.)

The above questions would also be appropriate to ask as you walk around the room while the children are arranging the yarn.

Then ask how many white curly shells there are in the whole class and how they could find this out. Make a large diagram of an arrangement of the yarn curves on the chalkboard. Lead the children to suggest some tallying method. For instance, each child, in turn, could bring his white curly shells up to the chalkboard and make one tally mark for each shell.



Ask if the set of tally marks represents the number in the set of white curly shells and how they know.

The lesson can be extended by asking if the white fan shells number as many as, more than, or less than the white curly shells. To find out, the children can make tally marks for their white fan shells on the diagram.

One satisfactory method of comparing numbers of tallies is to make a mark across one tally in each set until no more can be paired. Or, one tally can be erased from each set until the tallies are gone.

Lesson 9: UNDERSTANDING NUMBER NAMES

Explain to the children that number words and the written symbols for numbers may be different in different languages but that they are used to convey the same idea. The spoken and written symbols are both numerals. When asked how many fingers are on one hand, an English-speaking person says "five", and a Spanish-speaking person says "cinco" (SEEN-koh); both mean the same number. Demonstrate by counting the fingers of one hand in English and then in Spanish, or in some other language that may interest the children. (The lists of number words in eight languages at the end of this lesson are to help you choose a suitable example. Obviously, the lists should not be memorized by the children. But you may want to make bulletin board posters of the lists since some of the children may be interested in other countries.) Ask the children to hold up the number of fingers called for when you give the word for 3 in either English or Spanish.

Ask the children to help you to invent "new" number names for counting to five. By using the new word for 3 when asking for fingers to be held up, demonstrate that the new number name can serve the same purpose as the old one.

> WHY CAN'T WE USE THESE NEW NUMBER NAMES ALL THE TIME OUTSIDE OF CLASS? (The new number names would be useless unless everyone else learned them too.)

Write the numerals 1-9 on the blackboard or present them on a flannel board. Explain that by using these symbols we can tell how many we mean in writing. Discuss the importance of having symbols to represent numbers. Give examples: the record of the day's absences, a lumberyard order telling how many boards to send. Ask the children to suggest other examples.

Read the story, "Ruth Ann and the Number Names", perhaps at story time.

RUTH ANN AND THE NUMBER NAMES

While visiting her aunt who lived in San Francisco, Ruth Ann decided to buy a gift to take home to her mother. One afternoon she put some money into her purse, put on her yellow sweater, and started toward the store. She walked down the street and then around the corner. There were many stores on the street, and Ruth Ann couldn't decide which one to try first. As she was walking, she saw a very pretty hand-painted fan in the window of one store. She thought, "Mother would like a fan."

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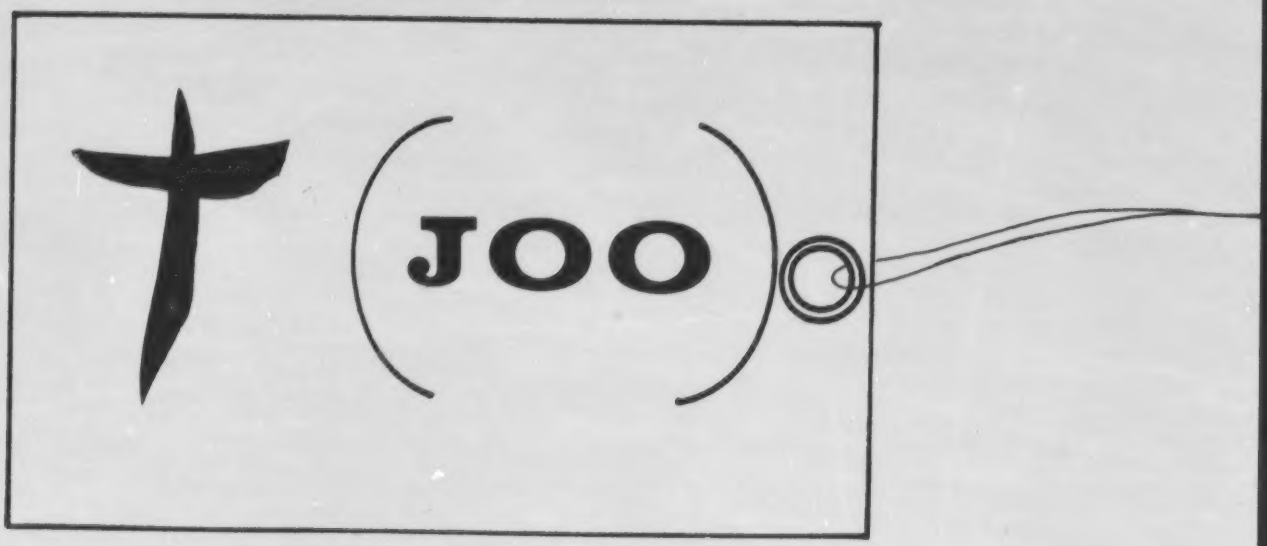
Ruth Ann went into the store, found the right counter, and picked out a lovely fan with a red tassle hanging from the handle.

She looked at the price tag to see how much the fan cost. The tag had a strange mark on it, and Ruth Ann couldn't understand what it meant. Then she picked up another fan and looked at the price tag; it too had a strange mark on it. She put the second fan down feeling very confused.

Show the illustration to the children.
This mark is the same as the one Ruth Ann saw on the first fan; it is pronounced JOO.
The second mark is pronounced ro-KOO.

After looking at the tags, Ruth Ann asked herself, "What kind of store is this? I can't read the price tags."


JOO

ro-KOO

A saleslady came up to Ruth Ann and asked, "May I help you?"

Ruth Ann saw that the saleslady wore a dress that was not at all like the dresses Ruth Ann's mother wore. The saleslady's dress hung down to her ankles. Around her waist, she had a wide sash with a big bow in back. Her shoes were wooden, and she had a very fancy hairdo with sticks poked into the hair on top.

"I want to buy this fan, but I can't read the price tag," Ruth Ann said politely.

The woman looked at the tag and said, "The price is ten cents."

Ruth Ann looked at the price tag again, and said, "Are you sure that says ten cents? I can't tell what that mark means."

The saleslady smiled at Ruth Ann and explained, "That mark means ten in Japanese. You see, this store sells things that are made in Japan. Many of the people who live in this neighborhood are from Japan. They can read Japanese symbols and like to see them on the price tags, but they can read our symbols also."

"But I thought all numbers were written 1, 2, 3, 4, 5, 6, 7, 8, 9, 10. Why do people from Japan write them differently?" Ruth Ann asked.

The saleslady said, "Everyone in the world knows what numbers are. Each language in the world has a word that means the same as one or two or three, and people in different parts of the world may make the mark for a number differently.

The saleslady then made Ruth Ann a chart that compared English and Japanese numerals and told Ruth Ann how to say the Japanese names.

Show the children the illustration and take the time to pronounce each of the Japanese number names.

After showing Ruth Ann the chart, the saleslady said, "Now you can see that Japanese-speaking people use a symbol for each number that is different from what you use."

"How do you know how to read those numbers?" Ruth Ann asked. "Why couldn't I read them?"

"I learned to read them when I was a little girl and lived in Japan," the saleslady said. "I also learned to read the numerals the way you write them. When I came to the United States, I had to learn to say 'one', 'two', and 'three' as you do."

Ruth Ann paid the saleslady the ten cents for the fan. As she walked back to her aunt's house, she wondered how numerals were written in other languages around the world.

JAPANESE
(pronounced)
1 一 ee-CHEE
2 二 NEE
3 三 SAHN
4 四 SHEE
5 五 GO
6 六 ro-KOO
7 七 shee-CHEE
8 八 ha-CHEE
9 九 KOO
10 十 JOO
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Spanish			French	
uno	OO-no	1	un	UNG
dos	DOHSS	2	deux	DUH
tres	TRAYSS	3	trois	TRWAH
quatro	KWAH-troh	4	quatre	KAHTR
cinco	SEEN-koh	5	cinq	SANK
seis	SAYS	6	six	SEESS
siete	SYAY-tay	7	sept	SET
ocho	O-cho	8	huit	WEET
nueve	NWEV-ay	9	neuf	NUF
diez	DYESS	10	dix	DEES

Russian			Norwegian	
Один	oh-DEEN	1	en	AYN
Два	DVA	2	to	TOH
Три	TREE	3	tre	TRAY
Четыре	chye-tir' ye	4	fire	FEE-reh
Пять	pyat'	5	fem	FEM
Шесть	shyest'	6	seks	SEKS
Семь	syem'	7	sju	SHOO
Восемь	vo syem'	8	atte	AWT-TEH
Девять	dye' vyat'	9	ni	NEE
Десять	dye' syat'	10	ti	TEE

Hebrew			German	
אַחַת	a-CHAT	1	eins	INS
שְׁתַּיִם	sh-TA-yim	2	zwei	TSVI
שָׁלֹשׁ	sh-LOSH	3	drei	DRI
אַרְבַּע	ar-BAH	4	vier	FEER
חָמֵשׁ	cha-MAISH	5	funf	FEWNF
שִׁשׁ	shaish	6	sechs	ZEKS
שֶׁבַע	SHE-vah	7	sieven	ZEE-ben
שְׁמוֹנֶה	shmoe-NEH	8	acht	AHKT
תֵּשַׁע	TAI-shah	9	neun	NOYN
עֶשֶׂר	EH-ser	10	zehn	TSANE

Italian			Swahili	
uno	OO-no	1	moja	MOH-jah
due	DOO-ay	2	mbili	MBEE-lee
tre	TRAY	3	tatu	TAH-tu
quattro	KWAHT-tro	4	nne	EN-nay
cinque	CHEEN-kway	5	tano	TAH-noh
sei	SAY	6	sita	SEE-tah
sette	SET-tay	7	saba	SAH-bah
otto	OHT-to	8	nane	NAH-nay
nove	NO-vay	9	tisa	TEE-sah
dieci	DYAY-chee	10	kumi	KOO-mee

Lesson 10: NUMBER AS A PROPERTY OF A SET

In this lesson the number of objects in a set and a numeral are associated. The number of members in a set is seen to be left unchanged when the set is rearranged.

MATERIALS

for the class:

— flannel board with sets of objects

for each child or group of children:

— a box of Minnebars

— a set of numeral cards, 0-10

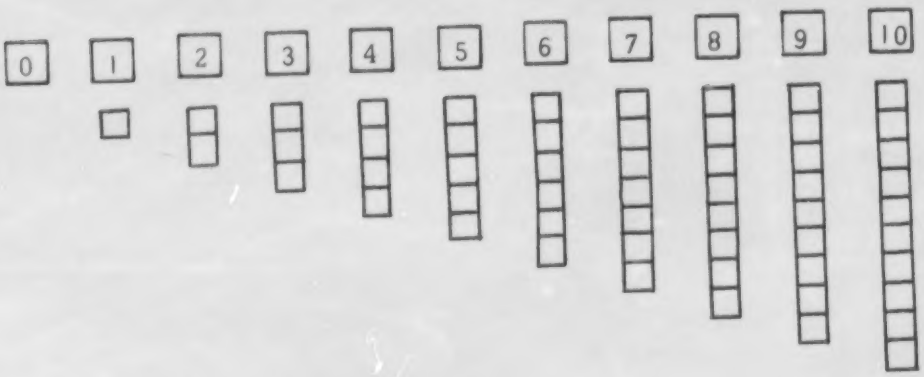
PROCEDURE

A. Place sets of objects on the flannel board. Have the children count, either together or individually. After recording the result on the board, rearrange the objects. Have them count again and observe that the result is unchanged.

For one example clear the flannel board of all objects. This shows the empty set, i.e., the set with no members. It contains 0 members.

A variation of this activity is to have each child hold up a numeral card that corresponds to the number in the set on the flannel board.

B. Have the children work individually or in small groups with a box of Minnebars and a set of numeral cards going from 0 to 10. The children should arrange the bars and cards in a pattern similar to that shown below. Have them start with the 1-unit bar, then the 2-unit bar, building the pattern in sequence. This strengthens the concept that each counting number is one more than its predecessor. After the pattern is built ask the children about the placement of the zero card.



The large demonstration Minnebars may be taped on the board in this pattern to allow the children to check their work.

Lesson 11: RECOGNIZING NUMBERS FROM 0 THROUGH 10

This lesson contains activities and games designed to help children associate any of the counting numbers from 0 through 10 with a numeral and a set containing that number of objects. Meaning is associated with the recitation of numbers in counting order.

MATERIALS

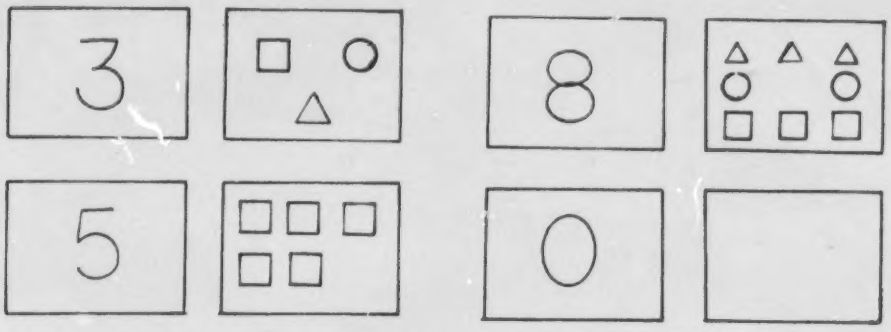
- one set of display cards (about 9" x 12") for 0 through 10
- several sets of 4" x 6" cards for 0 through 10
- several sets of 4" x 6" puzzle cards
- several sets of 4" x 6" game cards
  (Instructions for preparing these cards are given below. Similar cards and wooden puzzles for matching numerals with sets are available commercially.)
- 10 counters for each child
- 20-hole pegboard (optional)

PROCEDURE

The parts of this lesson should be used during several class periods. Parts A and B should be done first. Then use any or all of the other activities in any order that you choose to provide more practice. Several are individual or small group activities and can be done throughout the day. Encourage the children to make up their own variations of the games.

A. Display cards.

Prepare a set of eleven large cards (about 9 x 12) with the numerals from 0 to 10 on one side and a set of pictures of appropriate number on the opposite side. For example:



Notice that on these cards sometimes all the pictures are alike, sometimes all different, and sometimes only some are repeated. This is done so the child thinks of the abstract "threeness", for example, rather than thinking of "three alike" or "three different."

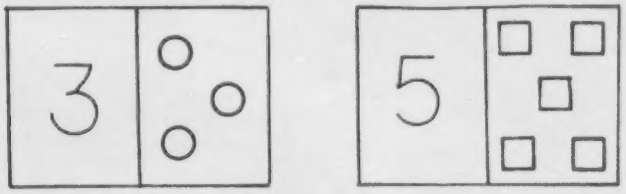
Hold the numerals up in random order before the class. As you hold a card up, the children should use counters to form a set containing that number of counters. When they have finished, turn your card over. The children then check to see that their sets of counters have the proper number in them.

B. Building the number sequence

Place any large numeral display card in the chalkboard tray with the picture side showing. Ask the children how many are in the set shown and write the numeral for the number above the card. Next ask a child, without looking at the numeral side, to find a card that has a picture of a set with one more member. Have him place the card he picks to the right of the other. Proceed developing the complete sequence by asking for cards that are either one more or one less than the end cards in the tray. When the number of the set is one less, place the card at the left end of the line of cards in the tray. When all the cards are placed in the chalkboard tray, ask the children to recite the number names in order.

C. Individual practice cards

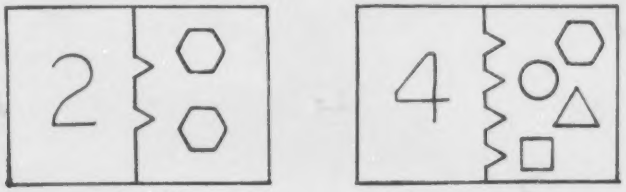
Use 4 x 6 index cards or small pieces of tagboard to make several sets of cards showing the numerals 0 through 10. Draw a line across the card. Print a numeral on one side and a corresponding set of object pictures on the other side. You may wish to have the children draw in or cut out and paste the pictures after you have written in the numeral. Leave the sets of these on the activity table for the children to use in their free time.



One possible activity with these cards is to have partners repeat activity B. The children should take turns placing cards in line until the number sequence is complete with 0 at the left and 10 at the right end of the line.

D. Puzzle cards

Make several sets such as those in the following example. Have the children spread them out and fit them together.



E. "What's Missing"

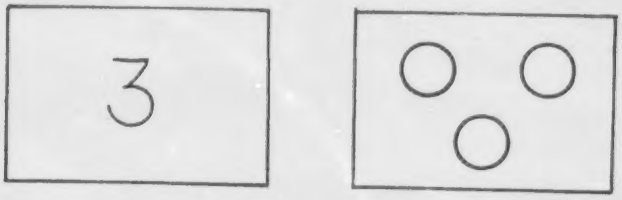
This game can be played by the class or by smaller groups. Place numeral cards 0 through 10 in order on the chalk ledge. When one child has left the room, one card is removed. The child returns and attempts to determine which numeral is missing. If he can't, he chooses a partner to help him. After he has determined the missing numeral, he chooses the next child to leave the room.

F. "Scramble"

This game is played like "What's Missing?" except that here the cards are out of order. The child playing may need to put them into counting order to determine the missing numeral.

G. Game cards

Use 4 x 6 index cards to make a few sets of cards with a numeral on one side and a corresponding set on the other. For example,



One game that uses these cards is played by partners. The partners, who each have 10 counters, place between them one pack of cards showing the numerals 0 through 10, with the picture side down. After choosing a card, the first player shows the numeral on it to the second player and says the name of the numeral. The second player places on the table a set of his counters equal in number to the numeral shown. If he is correct as checked by the picture side of the card, he gets one point. The players now change roles. Score can be kept by tally marks or a pegboard.

H. "How Many Pegs?" (optional)

Give a group of children the 20-hole pegboard without the slide. Have the pegs removed and 10 placed in a container. Have one child take a handful of pegs. The others guess how many he has. The number is found by placing the pegs in the pegboard holes and reading the results. This game provides background for the number line that will be introduced in Unit 11.

Lesson 12: RECOGNIZING NUMBERS FROM 11 THROUGH 20

After most of the children seem to have a good concept of the numbers from 0 through 10, introduce the numbers from 11 through 20. All the activities of Lesson 11 can be extended by using numbers from 0 through 20 rather than 0 through 10.

The children may consider each numeral from 10 through 20 as a single symbol at this time. The place value of the digits will first be discussed in the last section of Unit 11, Introducing Addition and Subtraction.

MATERIALS

- one set of display cards (about 9" x 12") for 11 through 20
- several sets of 4" x 6" cards for 11 through 20
- several sets of 4" x 6" puzzle cards
- several sets of 4" x 6" game cards
  (Instructions for preparing these cards are given in Lesson 11. Similar cards and wooden puzzles for matching numerals with sets are available commercially.)
- 20 counters for each child
- 20-hole pegboard (optional)

ACTIVITIES

Repeat activities from Lesson 11.

Lesson 13: ORDINAL WORDS

The emphasis in this lesson is on the ordinal words; that is, on the words "first", "second", "third", etc., as distinguished from "one", "two", "three", etc. The ordinal words are best established by incidental use in various class situations throughout the year.

MATERIALS

- set of 9" x 12" numeral cards, 1-20
- set of 20 different pictures

PROCEDURE

Game: "Name the Picture"

Post 20 cards, each containing one picture, across the chalkboard. The pictures should be of various familiar objects. (The children could draw or cut from magazines pictures of objects such as a house, dog, boy, girl, or ball.) Have a set of numeral cards from 1-20 available. The first child chooses a numeral card, say 15, and holds it up in front of the class. Each child silently counts the pictures starting at the left and counting over to the fifteenth, but doesn't say the name of the picture. The first child chooses a classmate, who should say, "The fifteenth picture is a (house)." If the answer is correct, the classmate starts over with a new numeral card.

After several repetitions of the preceeding game, ask a child to name a picture. Then the class silently counts to find the number of the picture. The first child chooses a classmate to say, "That's the (eighth) picture," and to find the correct numeral card.

Lesson 14: POEM: "THE DRAGONS OF ABRACAZAND"

The poem, "The Dragons of Abracazand," reviews the concepts of one-to-one correspondence and the use of a reference set to compare two other sets.

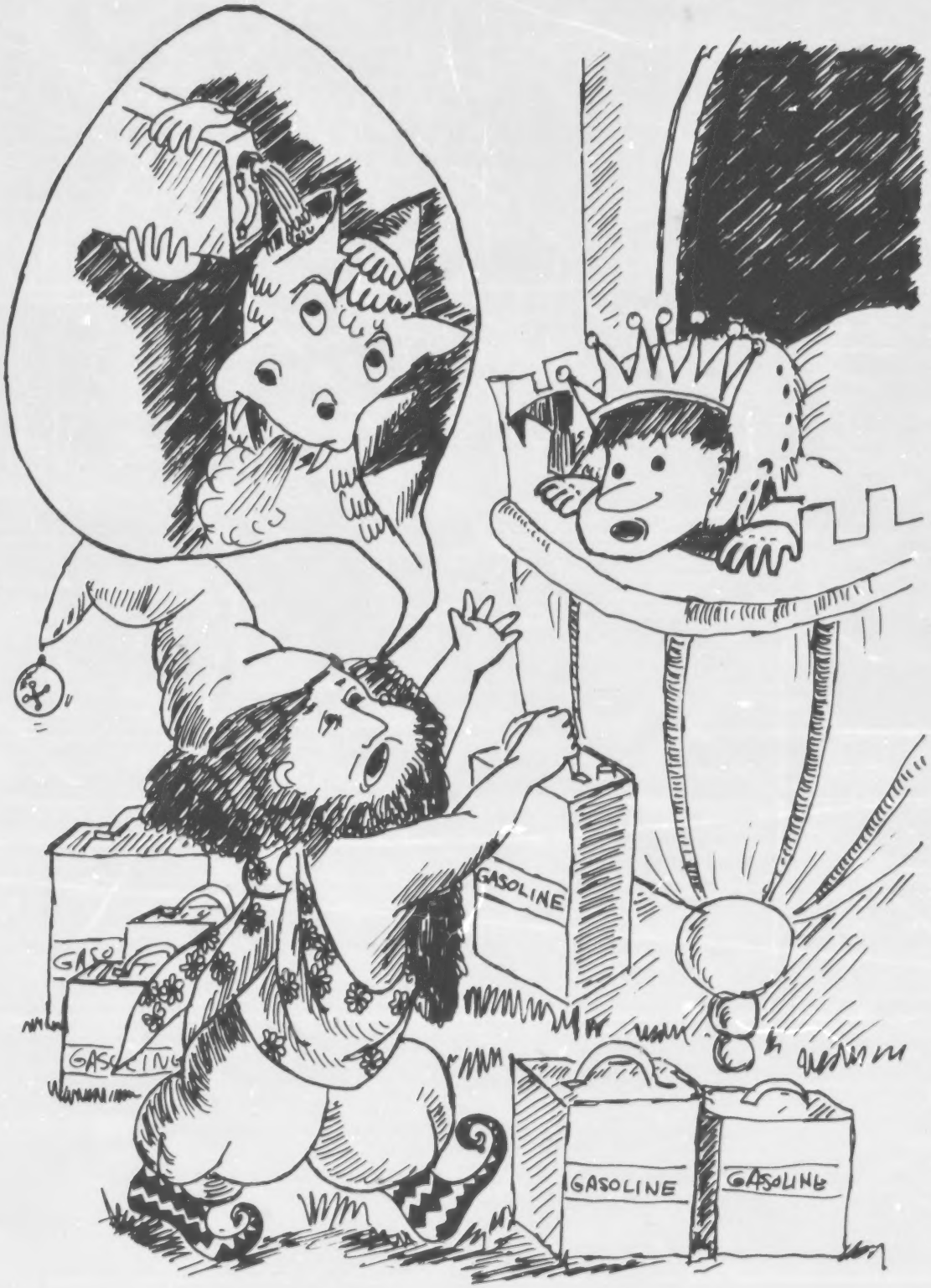
THE DRAGONS OF ABRACAZAND

Long, long ago in a far off land
There lived a king called Abracazand!
(Or something like that, maybe Abracazigh)
Who had a tall castle that touched the sky,
And he had a deep pit - a deep, dark spot,
Where he kept his dragons, and oh! it was hot
From the fiery breath of the beasts - such a lot!

The dragons were kept for defending his lands,
Against an attack by enemy bands.
Now dragons need fuel to keep them on fire,
And the price of their fuel went higher and higher
Till Abracazand said, "No fuel can we buy
Because the price is so terribly high."

Just then to the gate came a funny old man,
From a far away, far away, very strange land.
"I can sell you cheap fuel," he yelled to the king.
"It's a new kind of fuel and it's called gasoline.

"One can of this stuff will last for a year,
If fed to one dragon - just poured in his ear."
"But how much will I need?" asked Abracazand.
"Could you bring your cans here and match dragon for can?
One dragon - one can, and continue that way,
Till I have just enough! Now what do you say?"



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The funny old man gave a shake of his head.
The set of gas cans was too heavy, he said.
"The price of each can is one bag full of gold.
You'd better pay fast, or the fires will grow cold.
I'll be waiting right here with my gas cans at hand,
Bring a set of gold bags, old Abracazand."

Abracazand sat there thinking a bit
About how many dragons he had in the pit.
He didn't know how to count them, you know.
(Don't forget this was long, long ago.)
Said he, "Call the boy who scrubs all our pans
I hear he's the brightest boy in my lands.
Now Dick," said the king with a wave of his hand,
As Dick shook with fear before Abracazand,
"If you're really bright you'll be able to buy
Just enough gasoline from this guy."

"I want a can for each dragon. I can't count the beasts,
If you can't solve my problem, then you'll be their feast."

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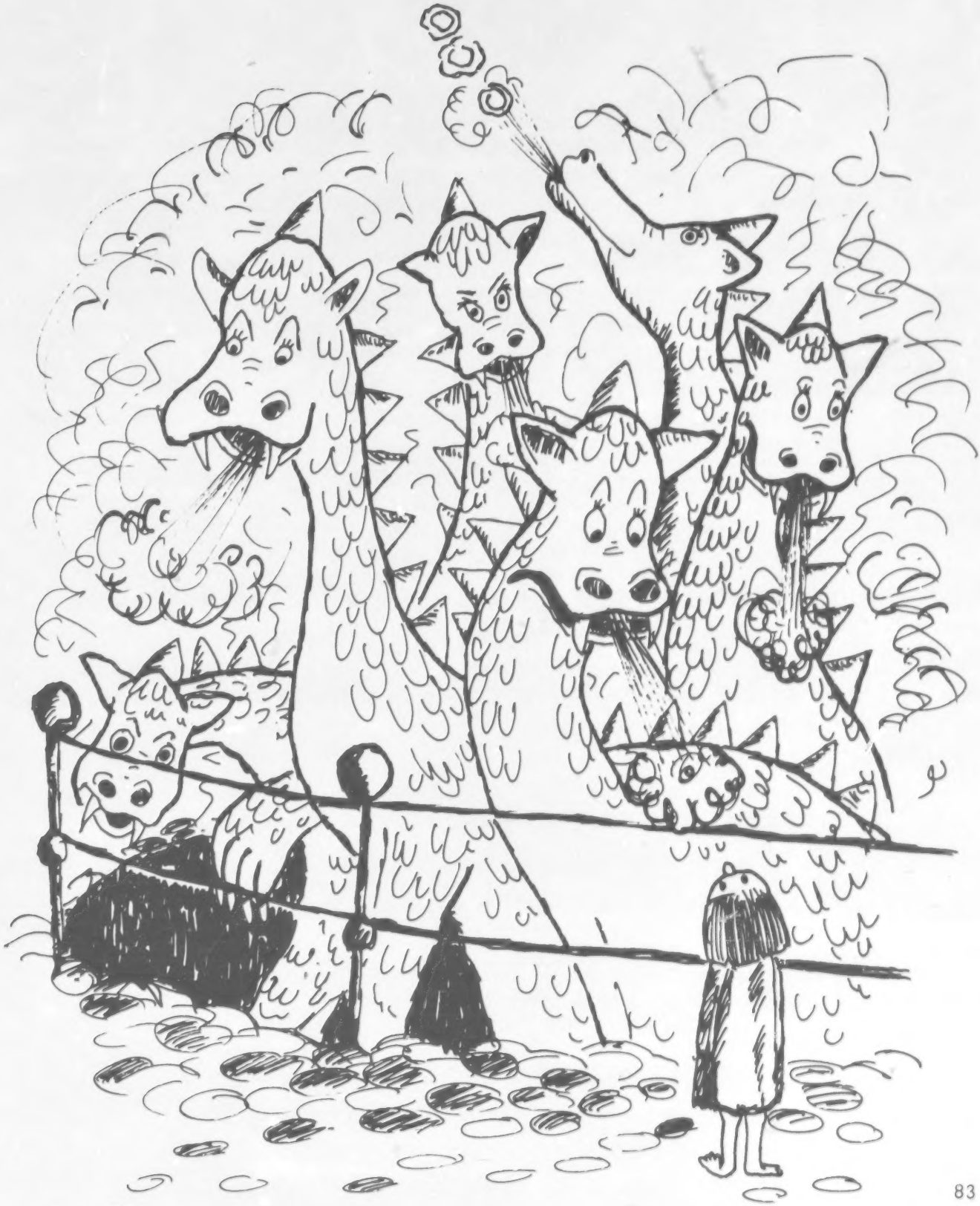
He meant he would throw poor Dick in the pit,
And the dragons would eat him up - every bit.
So Dick went to the pit to look for a way
To match dragons for cans and thus save the day.
The dragons were all lined up in the pit
Looking at Dick and drooling a bit.
Dick said to himself, "Oh, what a hot spot.
I wouldn't like that. Oh, certainly not."

As he leaned on the wall, he suddenly spied
A set of small sticks on a shelf by his side.
And quick as a wink an idea came to Dick
Which proved that he really could think mighty quick.
"One dragon, one stick," he said to himself
As he took a stick from the set on the shelf.



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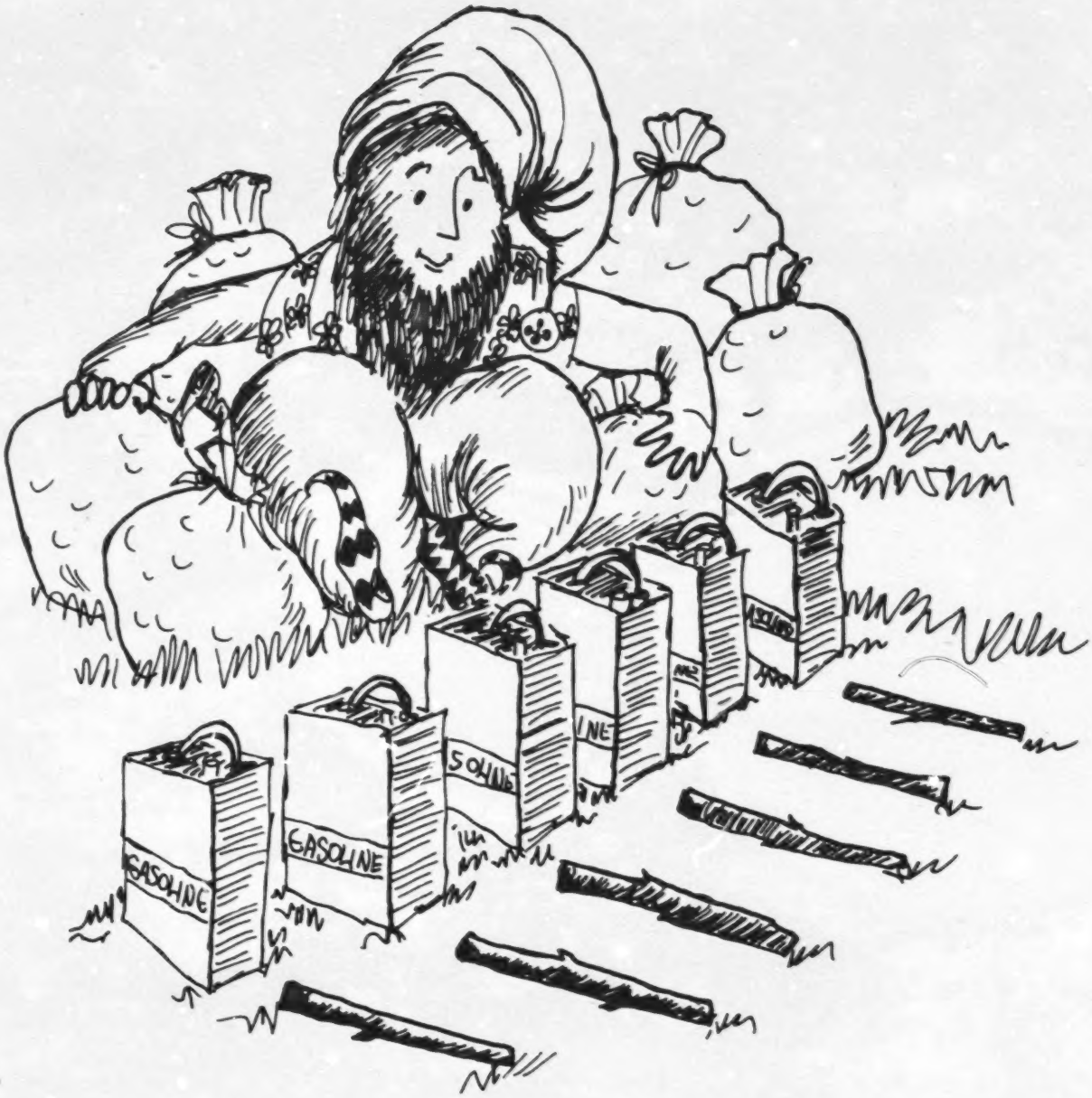
"One dragon, one stick," he said it again,
As he looked at the dragon next in the pen.
He took a stick for that one off the shelf.
He really was awfully proud of himself.
"One dragon, one stick," he said several times,
Till he had a stick for each beast in the line.
"There's a stick for each dragon, one beast for a stick,
No dragons left over and no extra stick."

With the sticks he was holding, he ran to the man,
Who was sitting outside on a gasoline can.
"Get up," said the boy. "Get your cans in a line.
I'll match them with sticks, one can at a time.
One stick, one can," he said to the man.
And he matched a stick to the very first can.
"One stick, one can," he said many times,
'Til there was a stick by each can in two lines.

"But there's one stick left over," he said to the man.
"There's a stick for each dragon and one for each can.

"But there's one stick left over that hasn't a can.
I need one more gas can for Abracazand."

So the man got a can from a place close at hand
To set by the last stick for Abracazand.
Each dragon would then have one can to himself,
And Dick put the stick-tallies back on the shelf.


GASOLINE
GASOLINE

Then Dick got some prizes, a solid gold wagon,
One gas can to keep and - you guessed it - a dragon.

Then Dick got some prizes, a solid gold wagon,
One gas can to keep and - you guessed it - a dragon.

SECTION 3 WRITING NUMERALS AND MORE COUNTING PRACTICE

PURPOSE

This section contains lessons that provide

— practice in writing the numerals from 0 to 20,

— reinforcement of the concept of number from 0 to 20.

COMMENTARY

For activities in Section 3, the children must be able to write numerals. You will probably prefer to follow your regular methods to teach the writing of numerals. However, if you wish, you may refer to Unit 6 in the MINNEMAST kindergarten program for detailed lessons on numeral writing.

Lesson 15: WRITING NUMERALS

MATERIALS

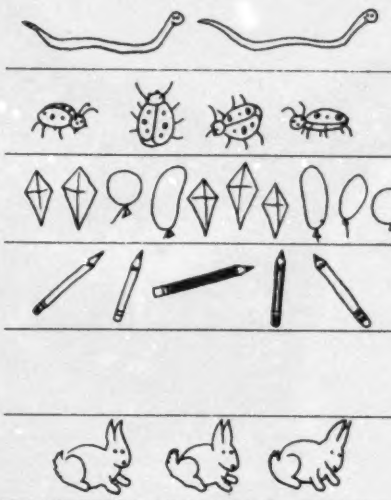
— Worksheets 3, 4, and 5

PROCEDURE

You may use Worksheets 3, 4, and 5 for writing instructions, but they are intended primarily for the identification of number concepts that need strengthening in some children. The children should fill in the appropriate numerals after counting the sets on the worksheets.

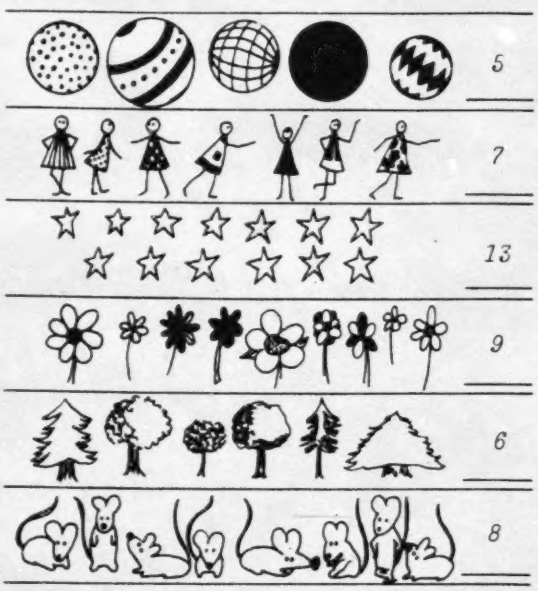
Worksheet 3
Unit 9 Name_____

Count the members in each set.
Write the numeral on the line.



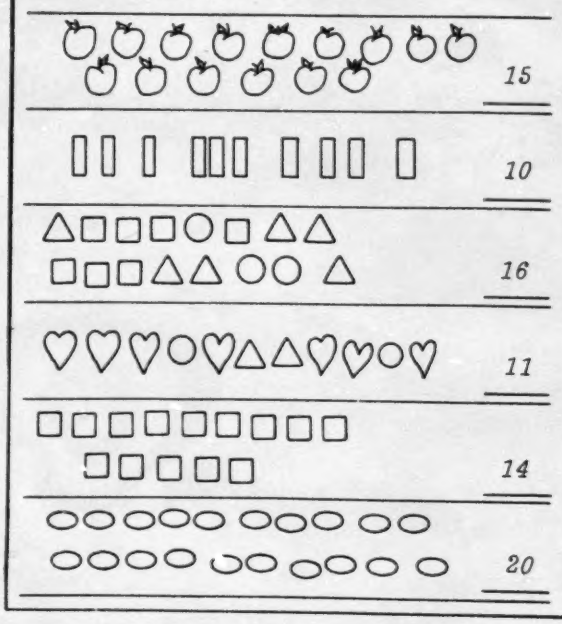
Worksheet 4
Unit 9 Name_____

Count the members in each set.
Write the numeral on the line.



Worksheet 5
Unit 9 Name_____

Count the members in each set.
Write the numeral on the line.



Lesson 16: GAMES TO IMPROVE NUMERAL WRITING

The three games described in this lesson provide further practice in reading and writing numerals. The first two games also help children to associate numerals with spoken words. The third game is especially easy.

MATERIALS

for each pair of children:

Game A

- one set of game cards showing numerals 0-20 and a corresponding set of objects
- newsprint and crayons

Game B

- one set of numeral cards with numerals 0-20
- pegboard and pegs
- pencil and paper for each child

Game C

- one set of numeral cards with numerals 0-20
- one pair of puzzles with an equal number of pieces

PROCEDURE

A. Game: "Hear it! Write it! See it!"
Arrange the children in pairs. One child should have the game cards, the other a sheet of newsprint and crayons.

The first child chooses a card from the deck and calls out the number without showing his partner. His partner then writes the appropriate numeral and draws a set of pictures with that number on his paper. The answer is then checked

with the game card. Have the children alternate roles. They may use tallies to record their successes.

If you prefer, you or one child could lead this as a group activity. After each child has written the numeral and drawn the set on paper, select one child to write the appropriate numeral and draw the set on the chalkboard.

B. Game: "Match it!"

This game should be played by partners. Each pair should have a set of numeral cards and a pegboard with pegs. A scoring track with marker from a children's game usually played with dice or a spinner may be substituted for the pegboard. Each child should have pencil and paper.

One child turns the set of cards face down and draws the top card. The game then proceeds as in the following example.

First child reads the card and says, "It's a three," without showing the card.

Second child writes numeral 3.

First child says, "That's a three. It's a match."

Second child moves three spaces on the pegboard.

If it is not a match, the child does not move the peg.

The children alternate roles until one or the other has reached the finish line on the pegboard.

C. Game: "Pencils and Puzzles"

This game is designed for children who are having difficulty with the writing of the numerals. Each pair of children playing this game should have a set of numeral cards and a pair of jigsaw puzzles.

One child turns the set of cards face down and draws the top card. He lays the card in front of him and writes the numeral on his paper. If he and his partner decide that the numeral

matches the card fairly well (you may have to watch this), he may fit a piece into his puzzle. The children then exchange roles. The first one to complete his puzzle is the winner.

If puzzles of more than 30 pieces are available, the child could write the numeral and fit that number of pieces into his puzzle.

Lesson 17: REVIEW OF NUMERAL RECOGNITION

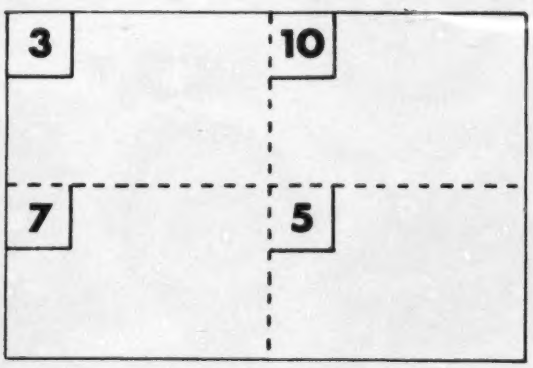
In this lesson the children are asked to draw sets of specified numbers of pictures. This provides practice and also tests whether a child can recognize and understand the meaning of a written numeral.

MATERIALS

— 12" x 18" newsprint and crayons

PROCEDURE

Have the children prepare sheets of 12" x 18" newsprint folded into four sections. A numeral should be written in a corner of each section.



Have the children draw sets containing the indicated number of pictures in each section.

Lesson 18: WRITING NUMERALS TO MATCH MINNEBAR SETS

This activity is much the same as that in Section 2, Lesson 10, except that here the children write the numeral associated with each set of Minnebars.

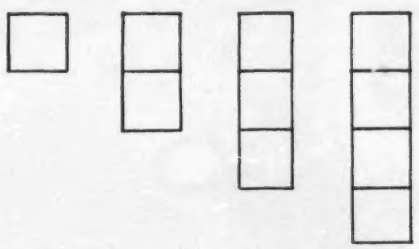
MATERIALS

— newsprint

— Minnebars

PROCEDURE

Ask the children to place their one-unit bar at the far left side of their paper. Next to that ask them to place a bar which has one more unit. Continue in this manner, asking each time for the bar which has one more unit.



AND SO ON

After 6 or 7 additions to the sequence, the children should write the number of units in each column above that column. Remind them to use a zero. This should reinforce the concept that each counting number is one more than the preceeding number.

Lesson 19: WRITING NUMERALS TO MATCH SETS OF COUNTERS (Optional)

Use this game for the children who need additional practice in writing a numeral which tells the number of members in a set.

MATERIALS

for each pair of children:

— two pegboards or other score-keeping devices

— counters

PROCEDURE

Arrange the children in pairs. One child should construct a set of counters with fewer than ten members. His partner then writes the numeral corresponding to the number in the set on his paper. If both agree, the writer can move his peg one hole forward on his pegboard. A set of numeral cards should be available to settle any disagreements. If the answer is wrong, the writer does not move his peg. The children alternate roles.

Variation: Play as a class activity. Draw a set of objects on the chalkboard or put a set of objects on the flannel board. Ask the children to write the appropriate numeral on their papers. When all have written the numeral, have one child write the correct numeral on the chalkboard. Every child whose numeral matches scores one. The scores should be kept at the top of their papers in tally marks.

SECTION 4 ORDERING AND THE ORDER-SIGNS

PURPOSE

This section contains activities designed

— to develop further the ability to order numbers,

— to introduce the < and > signs.

COMMENTARY

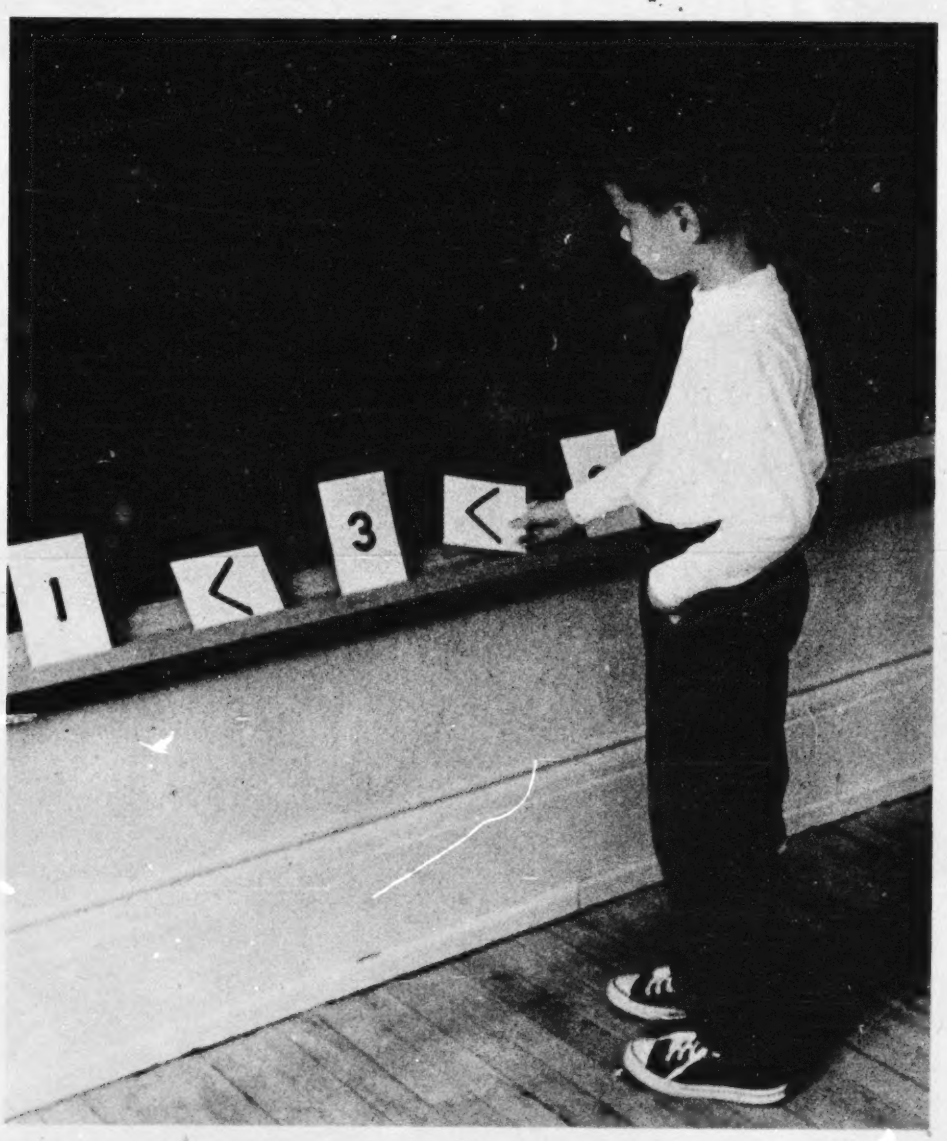
After completing Sections 1, 2, and 3, most children will have a fair idea of the order of the numbers from 0 through 20. However, a child may have trouble deciding whether 13 is a greater or lesser number than 15, for example. In this case he should construct a set of 13 elements and one of 15 and compare then directly by one-to-one pairing. Counters or Minnebars can be used for this comparison.

Most children will not be familiar with the order-signs which are written as < and >. (These signs are also called inequality symbols.) They will need much practice with them. Although it is correct to read either sign in either direction, the activities in this unit will ask for only left to right reading. The right to left reading of the symbols will come after children have strongly established the ordinary left to right movement in their reading. For example:

$4 < 6$ is correctly read "4 is less than 6" or "6 is greater than 4;" but in this unit the statement will be read only as "4 is less than 6." However, there will be activities to establish that if $a < b$, then $b > a$. That is, if $4 < 6$, then $6 > 4$.

Throughout the lesson the terms "less than" and "greater than" are used when comparing numbers. This terminology should avoid confusing the magnitude of the number and the size of the numeral. For example, the symbols $6 > 4$ are to be used to indicate that 6 in numerically greater than number 4; not that the numeral 6 is larger in size than the numeral 4.

It is likely that children will use the terms "bigger number," "smaller number," "larger number," etc. Accept these terms when they are used with a correct concept, but try to use the preferred terms "greater number" and "lesser number" when you speak to the children.



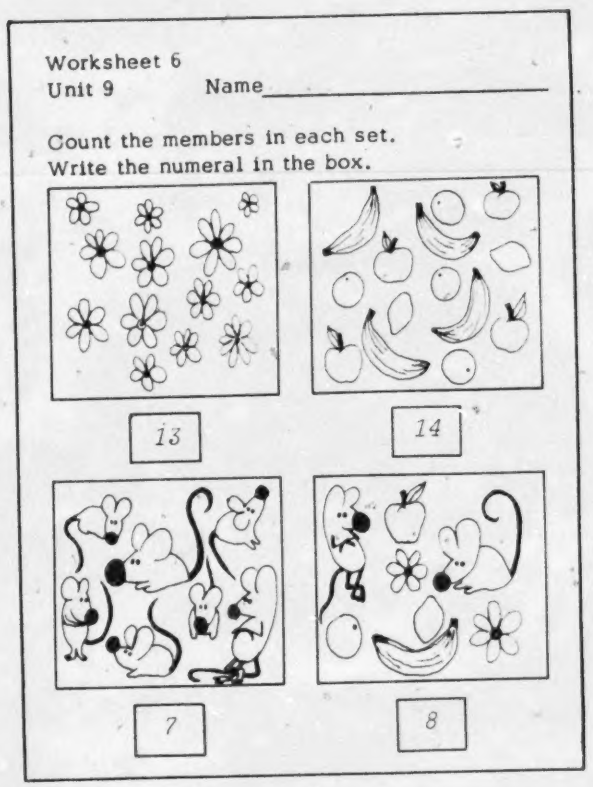
Lesson 20: COUNTING SETS ARRANGED IN A RANDOM PATTERN

Counting sets which are not in some orderly array presents difficulties, especially when the children are accustomed to worksheets which have objects lined up to be counted. The worksheets for this lesson enlarge the children's experience by presenting sets of objects in random patterns. The children will need to devise a method such as marking off each object as it is counted, to avoid omitting any.

MATERIALS

— Worksheets 6, 7, and 8

PROCEDURE

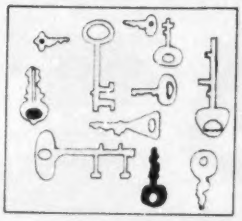


Explain to the children that in Worksheet 6 they are to count the objects and print the numeral in the box. Watch them as they work, asking such things as how they can be sure they have counted every object. Some may need to make a line of tally marks to count the sets.

After most are finished, discuss the results and various methods devised for marking off. Then proceed with Worksheets 7 and 8.

Worksheet 7
Unit 9 Name_____

Count the members in each set.
Write the numeral in the box.



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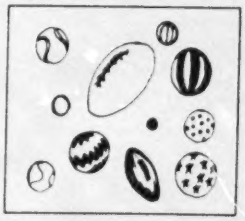

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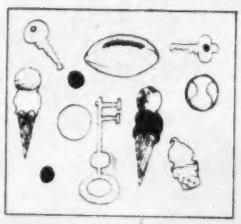

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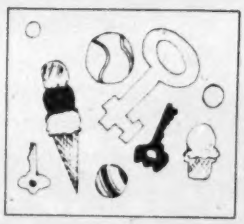

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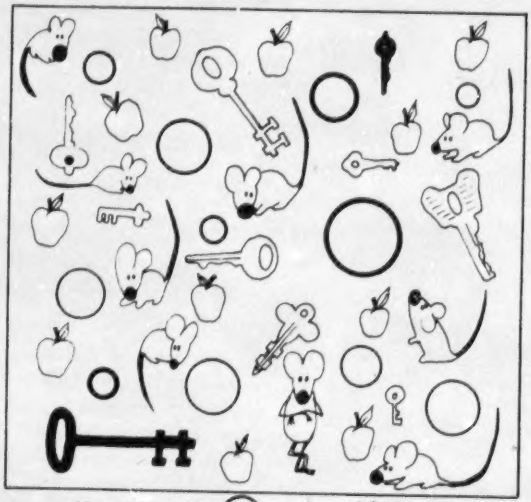
Worksheet 8
Unit 9 Name_____



How many 10

How many 10

How many 11

How many 9

111

Lesson 21: SEQUENCES OF NUMBERS

MATERIALS

— Worksheets 9, 10, 11, 12, and 13

PROCEDURE

Write two successive counting numbers such as 3 and 4 on the chalkboard. Have a child write the next number, giving in our example, 3, 4, 5. Work with several examples including those which require filling in the preceeding and middle number in a sequence, e.g.,

8, ____, 10 ____, 2, 3

Worksheets 9, 10, 11 give more practice in sequence development.

Worksheet 9
Unit 9 Name_____

Write the correct numeral on each line.

0, 1, 2	17, 18, 19
9, 10, 11	1, 2, 3
17, 18, 19	3, 4, 5
2, 3, 4	5, 6, 7
10, 11, 12	0, 1, 2
14, 15, 16	3, 4, 5
17, 18, 19	13, 14, 15
1, 2, 3	4, 5, 6
3, 4, 5	14, 15, 16
11, 12, 13	8, 9, 10

Worksheet 10
Unit 9 Name_____

Write the correct numeral on each line.

11, 12, 13	7, 8, 9
15, 16, 17	10, 11, 12
10, 11, 12	18, 19, 20
4, 5, 6	0, 1, 2
8, 9, 10	6, 7, 8
16, 17, 18	2, 3, 4
6, 7, 8	12, 13, 14
7, 8, 9	5, 6, 7
18, 19, 20	15, 16, 17
12, 13, 14	9, 10, 11

Worksheet 11
Unit 9 Name_____

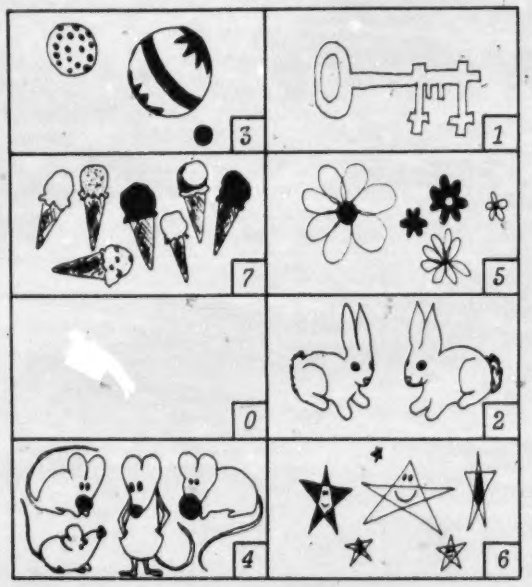
Write the correct numeral on each line.

4, 5 ,6	12, 13, 14
2 ,3, 4	8, 9 ,10
7 ,8, 9	16, 17 ,18
13, 14 ,15	12, 13, 14
15, 16, 17	12 ,13, 14
18 ,19, 20	9 ,10, 11
13 ,14, 15	13 ,14, 15
5, 6, 7	11, 12, 13
9, 10 ,11	16 ,17, 18
6 ,7, 8	10 ,11, 12

Worksheets 12 and 13 are sets of pictures to be cut out, counted, arranged in increasing order from left to right, and pasted on newsprint. Worksheet 12 deals with 0-7 and Worksheet 13 with 8-15. These may be done as separate activities or together.

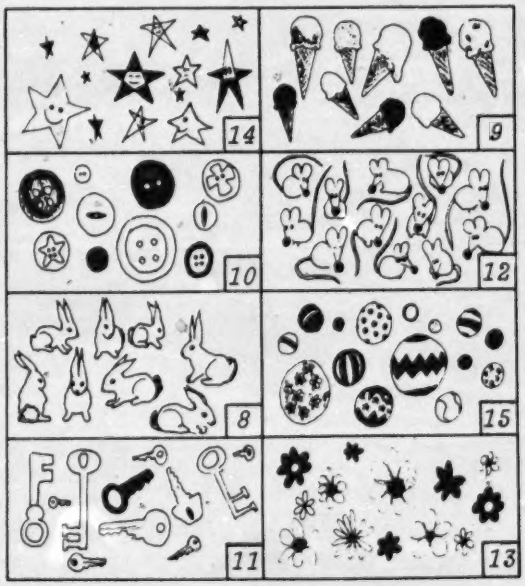
Worksheet 12
Unit 9 Name_____

Count and write the numeral in the small box.
Cut out. Paste in order.



Worksheet 13
Unit 9 Name_____

Count and write the numeral in the small box.
Cut out. Paste in order.



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Lesson 22: GREATEST AND LEAST NUMBERS

MATERIALS

— Worksheets 14 and 15

PROCEDURE

Write 13 and 15 on the board. Ask if anyone can tell which number is greater and how he can prove his statement.

You should guide the children to draw two sets containing 13 and 15 members and to compare these sets by one-to-one pairing. They should then be able to state and understand the following facts: The set of 15 members has left-over, unpaired objects. The set of 15 has more members than the set of 13 members. Conversely, the set of 13 members has fewer members than the set of 15 members. Therefore, 15 is greater than 13 and 13 is less than 15.

Worksheet 14 and 15 can now be done by the children. Worksheet 14 presents the idea of the greatest number in a set of three numbers. Worksheet 15 presents the idea of the least number in a set of three numbers.

Worksheet 14
Unit 9 Name_____

Make a closed curve around the greatest number in each box.

6 (8) 2	4 (7) 5
3 7 (9)	(16) 12 11
2 10 (12)	11 10 (12)
11 (14) 13	13 14 (15)
16 (19) 10	16 17 (18)
17 (19) 15	(18) 16 17
1 0 (2)	15 6 (16)

Worksheet 15
Unit 9 Name_____

Make a closed curve around the least number in each box.

12 10 (9)	16 (0) 1
8 (6) 12	17 (7) 11
(11) 13 15	18 (8) 9
16 10 (9)	(7) 8 9
16 (6) 10	(4) 5 6
(7) 17 8	(14) 15 16
18 (2) 10	(11) 13 16

Lesson 23: INTRODUCTION OF THE < AND > SYMBOLS

This lesson introduces the symbols used to show order. It also uses the principle that the order relation is transitive. This means that if the first number is less than the second number, and if the second number is less than the third number, then the first number is also less than the third number. This may be written as follows in symbolic form, where a, b, and c each represent any number.

If $a < b$, and if $b < c$, then $a < c$. Of course, the following is also true. If $a > b$, and if $b > c$, then $a > c$.

MATERIALS

for each child:

- two order-sign cards, < and >
  (additional order-sign cards can easily be made on slips of paper)
- a set of numeral cards, 0-20
- 20 counters, which need not all be the same
- Minnebars (optional)

PROCEDURE

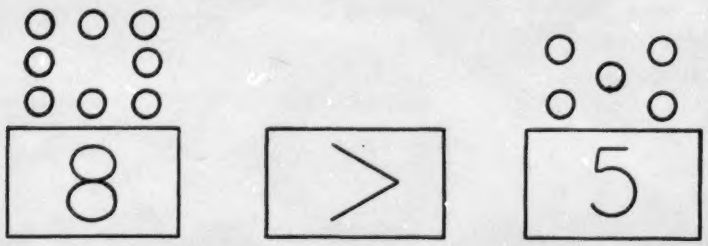
Have each child place his cards and counters on his desk. Minnebars may be used instead of the counters.

Have the children count 8 objects and put them on the left of their desks. In front of the objects they should put the "8" numeral card. Then have them count out another set containing 5 objects and put these on the right of their desks. They should put the number 5 numeral card in front of these objects.

WHICH SET HAS MORE OBJECTS? HOW CAN WE TELL FOR SURE? (By pairing the objects. The set with unmatched objects has more objects.)

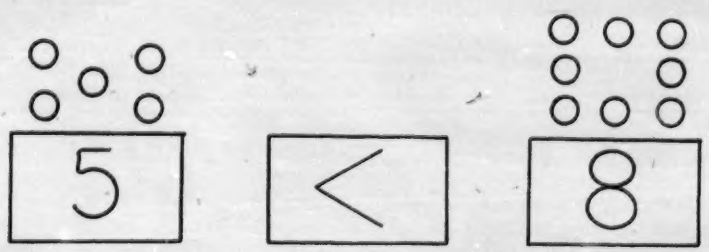
Have the children put an order-sign card between the numeral cards. Explain that the big, open end of the wedge should face the greater number, and the small, pointed end of the

wedge should face the lesser number. Each desk should look like this:



Someone, either you or a volunteer, should read this number sentence. Read it as "8 is greater than 5." Recall that "5 is less than 8" is also correct, but this reading won't be stressed here.

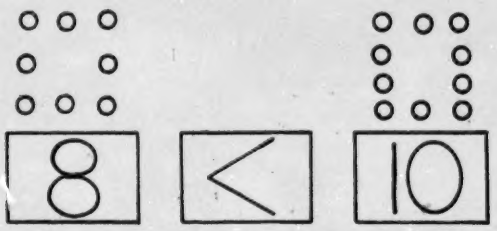
Now have the children put the counters and cards back. Again have them count out sets of 5 and 8, this time placing the set of 5 to the left and the set of 8 to the right. Have them put the appropriate numeral cards in front of the sets. Then have them place an order-sign card between the numeral cards. If necessary, remind the children that the big, open end of the wedge faces the greater number and the small, pointed end faces the lesser number. The arrangement should be:



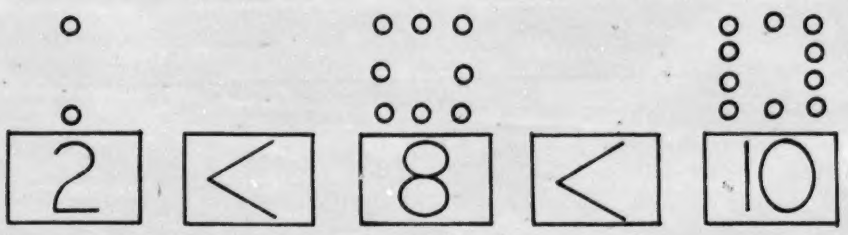
The number sentence should be read aloud: "5 is less than 8."

If the children have little difficulty with this activity, go on to the next; otherwise, repeat the above with other numbers.

After the children have cleared their desks, have them get out the numeral cards that read 8 and 10. Have them place the 8-card in the middle and the 10-card at the right of their desks. Then have them count out appropriate sets of counters, place them above the numeral cards, and put in an order-card. The result will be this:



Next ask the children to take out the 2-card and count out a set of two objects. Ask them to move the card and set into the proper position on their desks and put in the order-sign card. The result should be:



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Ask for a volunteer to read this number sentence. If no one can do so, cover up the ☐ 10 and have the uncovered portion read. Repeat covering the 2 ☐. Although there are several ways to read the sentence, probably the easiest is "2 is less than 8 and 8 is less than 10." Ask questions such as, "Which is less, 2 or 10?" "Which is greater, 8 or 10?"

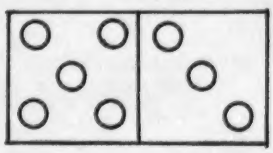
Repeat this last section with different combinations of three numbers.

Lesson 24: THE RELATION BETWEEN < AND >

This lesson reinforces the idea that if a < b, then b > a, where a and b are symbols for arbitrary numbers.

MATERIALS

— flannel board or card board with a pattern similar to this:



— Worksheets 16 and 17

— dominoes (optional)

PROCEDURE

Free play with dominoes will help children recognize the patterns that will be used here.

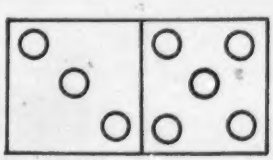
Show the pattern on the flannel board to the class.

HOW MANY SPOTS ARE THERE IN THE SET TO THE LEFT? (5)

TO THE RIGHT? (3)

Have someone write these numerals on the board. Have the proper order symbol placed between the numerals. (5 > 3) Ask someone to read the inequality 5 > 3.

Turn the pattern so it looks like this:



Have the numerals and order-sign (inequality sign) written on the board. (3 < 5)

Again discuss the fact that the order-sign is placed with the open side toward the greater numeral and the pointed end toward the lesser numeral.

Sets with different numbers of members may now be used, if the children need further experience before using the worksheets.

Variation: The above procedure may be varied by substituting counter arrangements on a table instead of the flannel board or cardboard arrangements. The children can walk around the table to view the pattern from both sides. They should discover that $3 < 5$ and $5 > 3$ are just two different ways of describing the same relationship.

Worksheet 16 will probably need little explanation. Simply read the instructions for each box with the children. As an introduction to Worksheet 17, write several examples such as those on the worksheet (e.g., ____ > 3) and have various children fill in any numeral which would make the sentence correct. Have the statements read. Remind the children that there are usually many correct answers.

Worksheet 16
Unit 9 Name_____

Draw a red line under the larger number.

$2 < \underline{8}$	$\underline{1} > 0$
$5 < \underline{6}$	$0 < \underline{1}$
$\underline{8} > 2$	$3 < \underline{4}$
$\underline{6} > 5$	$\underline{9} > 6$
$\underline{4} > 3$	$\underline{5} > 1$

Draw a blue line under the smaller number.

$\underline{2} < 8$	$1 > \underline{0}$
$\underline{5} < 6$	$\underline{0} < 1$
$8 > \underline{2}$	$\underline{3} < 4$
$6 > \underline{5}$	$9 > \underline{6}$
$4 > \underline{3}$	$5 > \underline{1}$

Worksheet 17
Unit 9 Name_____

Put in any number that will make these true.

$\square > 4$	$\square > 10$
$\square > 10$	$\square > 6$
$\square > 15$	$\square > 8$
$\square > 2$	$\square > 13$
$8 < \square$	$3 < \square$
$2 < \square$	$5 < \square$
$4 < \square$	$11 < \square$
$10 < \square$	$13 < \square$
$\square > 6$	$9 < \square$
$9 < \square$	$\square > 11$
$\square > 7$	$6 < \square$
$\square > 3$	$\square > 12$

Lesson 25: PRACTICE WITH ORDERING

MATERIALS

for each child:

— two sets numeral cards 0-20

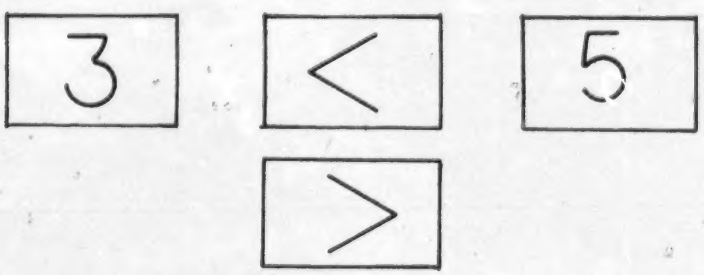
— two order-sign cards, < and >

— a die

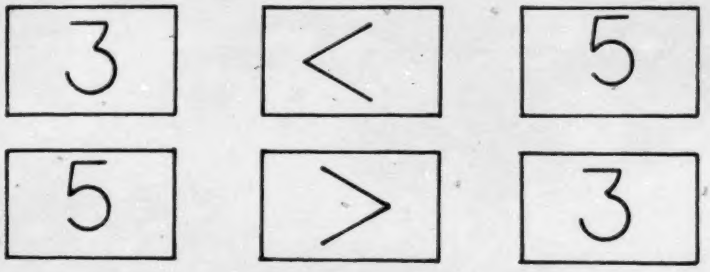
— Worksheets 18, 19, and 20

PROCEDURE

A. Give each child a set of numeral cards, 0-20, and two order-sign cards. For extra cards, the children can write the numerals on slips of paper. Ask each child to take any two different numerals and put them on his desk with the order-sign card between them. After all have done this, each child should put his other order-sign card with its pointed end just below the large open end of the first card, like this:



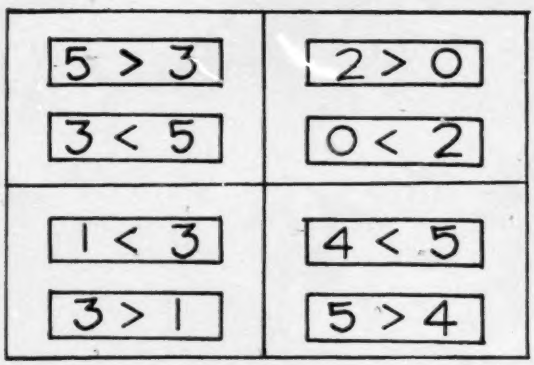
Now have the children make duplicates of their numeral cards and put them in positions that will make a correct number sentence, like this:



There should be some practice in reading these pairs, perhaps as "3 is less than 5, and 5 is greater than 3."

B. For further practice in ordering, pairs of children can cast dice and determine whose die shows the greater number.

C. There are three worksheets which should follow this lesson. On the first, Worksheet 18, instruct the children to fold a piece of newsprint into 4 sections. Then they should cut out the boxes on the worksheet. Tell them to find pairs of inequalities which mean the same thing and paste each pair in one section of the newsprint. Completed, it should look something like this:



Have several children read the resulting pairs.

Worksheet 18
Unit 9 Name_____

Cut.
Make pairs.
Paste.

5>3	4<5
5>4	0<2
1<3	3<5
2>0	3>1

Worksheet 19 involves filling in the appropriate order-signs in pairs of inequalities.

The children may need some group practice writing their own inequalities before doing Worksheet 20.

Worksheet 19
Unit 9 Name_____

Put in > or <.

1 < 10	10 > 1	9 > 6	6 < 9
7 > 5	5 < 7	0 < 5	5 > 0
4 < 8	8 > 4	11 < 14	14 > 11
0 < 2	2 > 0	19 > 9	9 < 19
16 > 12	12 < 16	6 < 16	16 > 6
15 < 20	20 > 15	5 < 18	18 > 5
13 < 14	14 > 13	2 < 5	5 > 2

Worksheet 20
Unit 9 Name_____

Make your own number sentences.
Be sure the larger, open end of the > or < is nearer the larger number.

>	<
>	<
>	<
>	<
<	<
>	<
<	>
>	<